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KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. VII. MAY, 1883. NO. 1.

PROCEEDINGS OF SOCIETIES.

THE UNVEILING OF THE STATUE OF PROF. JOSEPH HENRY AT WASHINGTON.

On Thursday, April 19th, the ceremonies attendant upon the unveiling of the statue of Prof. Henry were performed by the National Academy of Sciences. We find the following account of them in the *National Republican* of the 20th *ultimo:*

Just at the left of the statue, which was closely wrapped, effectually preventing any glimpse of its actual appearance, was a raised platform covered with a handsome Persian rug on which were three chairs. These were for the Chief Justice, the orator, and the chaplain. The marine band was stationed immediately back of this stage, while the chorus was arranged on either side of the band.

Precisely at 4 o'clock, the hour appointed, the strains of the band were heard, and to the music of a grand march, "The Transit of Venus," the long procession of dignitaries marched from the museum to the platform.

Chief-Justice Waite, President Noah Porter, and Rev. A. A. Hodge then ascended the stage and took their seats, and without any delay Mr. Sousa, the leader of the marine band, waved his baton, and the grand Hallelujah chorus from Handel's "Messiah" was performed in superb style. The Chief Justice then announced that the Rev. Dr. Hodge would make the prayer, and nearly the entire assemblage rose to their feet, the men standing with uncovered heads while the reverend gentleman invoked the divine blessing.

"Eternal and almighty God, who from Thy throne in heaven dost look down upon Thy children in love, we thank Thee for the opportunity of meeting here on this occasion. We bless Thee that when Thou didst create this world Thou didst give unto Thy creatures the power of discernment of Thy law. We thank Thee that as thou didst send forth Thy prophets, so didst Thou also send Thy spirit unto Thy children that they might know and interpret the laws of this temporal life even as thy servants of old have shown us the way of the life to come. We bless Thee that Thou hast given unto us so much of an appreciation of the merits of our fellow man, that so many of us are gathered here to do honor to the memory of the man whose statute we are now to unveil. And we ask Thee, our Father, that as he has served his race and loved his God, his memory may live for all generations, teaching posterity that those who serve their Creator best, serve also His creatures best. We bless Thee for all Thy mercies with us and ascribe unto Thee all honor, glory, dominion, and power, forever, amen."

At the conclusion of the prayer Chief Justice Waite, chancellor of the Smithsonian Institution, delivered the following address:

"On the first of June, 1880, at the instance of Mr. Morrill, of Vermont, in the Senate, and of Mr. Clymer, of Pennsylvania, in the house of representatives, congress authorized the regents of the Smithsonian institution to contract with Mr. W. W. Story "for a statue in bronze of Joseph Henry, late secretary of the Smithsonian institution;" and, availing themselves of the presence in Washington of the members of the National Academy of Sciences, with which Prof. Henry was so prominently and honorably connected for many years, the regents have asked you here to-day to witness the presentation to the public of the result of what has been done under this authority.

On the tenth of August, 1846, congress established the Smithsonian Institution to take the property which had been given to the United States by the will of James Smithson, of England, to found an establishment of that name "for the increase and diffusion of knowledge among men."

The business of the Institution was to be managed by a board of regents, and they were required to elect some suitable person as Secretary of the Institution.

On the third of December, 1846, the board met to perform that duty, and before entering on the election, adopted the following resolution:

Resolved, That it is essential for the advancement of the proper interests of the trust that the Secretary of the Smithsonian Institution be a man possessing weight of character and a high grade of talent; and that it is further desirable that he possess eminent scientific and general acquirements; that he be a man capable of advancing science and promoting letters by original research and effort, well qualified to act as a respected channel of communication between the Institution and scientific and literary individuals and societies in this and foreign countries; and, in a word, a man worthy to represent before the world of science and letters the Institution over which this board presides.

Immediately on the adoption of the resolution the board proceeded to the election, and the first ballot resulted in the choice of Professor Henry, then occupy-

ing the chair of Natural Philosophy in Princeton college. Experience has shown that the world possessed no better man for such a place. He was all the resolution required and more; and from the day of his election until now, the wish has never been expressed that another had been chosen in his stead.

He accepted the appointment on the seventh of December, and on the next day, the eighth, finished and sent to the regents an elaborate paper, giving his views of the will of Smithson, and presenting a plan for the organization of the institution. He entered on the discharge of his duties on the twenty-first of December, and from that day until his death, lamented by all, on the thirteenth of May, 1878—almost one third of a century—he was engaged in making the Smithsonian Institution what its munificent founder desired—an active and efficient instrument for the increase and diffusion of knowledge.

He was faithful to every duty, active in every work, and during his long official service lost no opportunity of making his trust what it was intended to be.

The statue which will now be unveiled has been erected by the United States as a token of gratitude for the labors of his useful life and for his faithful administration of the important public trust so long in his keeping."

Just as the Chief Justice finished speaking the lanyards were pulled, the covering fell away, and the statue of Joseph Henry was exposed to the view of the vast multitude, who greeted it with loud applause. The shapely head looked to the south and the far reaching eye bent its gaze, as on some distant object, beyond mortal reach. The sun, so long obscured, had at last pierced the cloud mantle that enveloped it, and as the veil of the statue dropped the sunshine fell on the well known head, gilding its bronze features with a golden glory. In the bright sunlight of accumulating truths had the great philosopher lived, and the first view of his statue in the open air was wrapped in the sunshine still.

Hardly had the applause subsided when the grand chorus, accompanied by the full marine band, sung "The Heavens are Telling," from Hayden's "Creation," under the leadership of Prof. R. C. Bernays, with a volume of harmony rarely heard, and never before listened to in the open air in this city.

When the last chord had died away the Chief Justice introduced Rev. Dr. Noah Porter, President of Yale College, who had been selected as the orator of the occasion. Dr. Porter said:

"We are assembled to complete the long series of public honors to the late Joseph Henry as we unveil the statue which has been erected to his memory. These honors have been manifold, but all have been well deserved and most cordially bestowed. His funeral obsequies were attended by the President of the United States and other officials of the Government which he had so faithfully served, by representatives from many learned and scientific societies of which he was a conspicuous member and ornament, and by a large following of those who honored and mourned him as a friend. Subsequently a more formal commemoration of his scientific and public services was held at the Capitol, at which were present the Executive of the Nation, the Judiciary, the Senate and House of Representatives. On this occasion a discriminating and sympathizing sketch of

his personal and public life was given by one who had known him long, and was singularly qualified to do him justice in every particular. This was followed by other warm and eloquent tributes to his genius as a philosopher and his excellence as a man. Memorable among these were the ringing words of the noble Rogers, whose own sudden euthanasia was like the translation of a prophet, and the warm-hearted eulogy of the generous and glowing Garfield, whose noble life was slowly wasted that it might measure the intensity of the Nation's sorrow. Many if not all of the institutions of the country with which Prof. Henry had a more or less intimate connection, have honored him by records and estimates of his services to science, education, and philosophy. The tributes to his honor from other countries have also been hearty and numerous.

Last of all, the two houses of congress, with the approval of the President, have ordered that a statue in bronze should be erected within the grounds of the institution which was the creation of his genius and industry, as a permanent memorial of his services and worth. This statue is now completed and has this moment been unveiled to public view. We are assembled to receive the first impressions of this enduring monument, which we trust will stand for many generations and declare the fame and attest the manifold excellences of this eminent servant of science and benefactor of the American people."

Dr. Porter then proceeded to sketch the boyish life and initial investigations of Henry. His portrait of the sensitive and dreamy boy, "who found enough in the common earth and air and the play of common scenes to stimulate his creative powers and to furnish material for his long day dreams, as he lay on the sunny hillside and looked into the glowing sky," was striking and graphic. The economies of the boy's household were straitened, but not ignoble. The brief space of time in which he cultivated the imaginative was gracefully touched on. and the awakening to the inducements of science was also beautifully portrayed. His calm, gradual, but sure progress onward was described, until he became a professor in the Albany academy.

"At the age of twenty-eight we find him a professor in the academy at Albany, of which he had been a graduate, tasked with the work of teaching several hours every day, and tasking himself with burning zeal over every possible inquiry in chemistry and physics. As we have said already, it was in the brilliant dawn of modern chemistry. As the new science steadily rose above the horizon, one new discovery after another flashed its light toward the zenith and indicated its upward path of triumph. In its train appeared those new and mysterious agencies which were then just beginning to fix the attention and to task the analysis of the oldest and newest discoverer. To those novel phenomena the young Professor Henry devoted his special attention and soon astonished the world by achievements which first awakened the excitement of bewildered wonder to convert it into the homage of amazed conviction. There was nothing to be said when as the plunger went down into its bath the impotent bar of iron became possessed of a giant's strength and could pick up and hold a weight of more than a solid ton, and as the same plunger was lifted this gigantic energy vanished as at the word of an

enchanter. The speaker well remembers the excitement which this discovery occasioned when the first experiment was tried at Yale College in the presence of a few spectators who casually met at the call of Professor Silliman, who was glowing with animation and delight. The ponderous platform was loaded with pig iron and other heavy weights, with a few slight additions of living freight. Among the last was the speaker, being the lightest of all and, therefore, convenient to serve on the sliding scale. It is more than fifty years ago, but the scene is as vivid as the event of yesterday."

Briefly noting the successive discoveries of the daring young scientist in the same field until they made assured the telegraph and the telephone, with their wonders of written language and audible speech, the orator continued:

"From Albany, in the year 1832, Professor Henry was transferred to Princeton through the wise sagacity of our honored associate, Rev. President John Maclean, and the generous and cordial recommendations of some of the most honored leaders of American science. The step was a bold one, and might seem almost rash, to transfer to a college a man who had himself lacked the breadth of early culture and the discipline and variety of scientific thought which the college curriculum is supposed to give. His insight into nature's secrets might seem to be magical; but for this very reason could he share this secret with his pupils? Would not the very swiftness of his own processes of thought disqualify him from imparting them to others? Would not the lightning rapidity with which, as a discoverer, he had leaped from indication to theory and combined probabilities into evidence hinder him from discerning that there were any steps in the process or any articulation in the proofs? Whatever misgivings of this sort there might have been—and the failures in teaching of many eminent scientists have proved that they were not without reason—were all set aside by his acknowledged skill as an instructor at Albany and his prominent success at Princton. Not only did he give himself to instruction with exemplary zeal and painstaking, but he studied the theory of teaching as he studied electro-magnetism, by reflecting upon its conditions and laws, and using wise experiments in concrete applications. He did more. He used his special studies as examples of general philosophical inquiry, whatever might be the subject matter, and sought by means of these to introduce his pupils to the theory of inductive research and the nature of scientific evidence, however they should be applied. This was a subject which he had ever at heart, the discipline of the mind to a true philosophic method as the best preparation and security for sound science, clear insight, strong convictions, and practical wisdom.

This active and fruitful life continued for fourteen years, when, at the age of forty-eight, in the year 1846, he was called to Washington as the first secretary of the Smithsonian Institution.

At first it might seem that a situation like this would be attractive to any man, but on second thought many reasons would suggest themselves why, to a man like Professor Henry, interested as he was in teaching, devoted to research and with the scientific world watching eagerly his experiments, the attractions of

the place should be scanty and feeble. It is only when we learn how he regarded the possibilities and demands of the place, and his own capacity and purpose to meet them, that we can explain the readiness with which he responded to this call. The secretary was to initiate and control the policy of a novel institution, with a handsome but not extravagant endowment given to the United States for the increase and diffusion of knowledge among men. Loosely interpreted, the terms of the gift might admit any application of popular usefulness. But when read in the light of the known tastes of the giver and the previous bequest of the estate to a society which was severely scientific in its functions, and especially when interpreted by the eminent need and certain usefulness of a special application, it was clear to Professor Henry that it should be used exclusively in the interests of the increase and diffusion of scientific knowledge. He foresaw and foretold that his theory would at first encounter active dissent and opposition. He was equally confident that it would finally become popular and attractive. Before he entered upon his duties the institution had been partially committed to another policy. It was not until after eight years of discussion and reports in committees and in both houses of congress, in which some of the ablest and most brilliant members were conspicuous, that the policy of Professor Henry at last prevailed, and has ever since justified itself to the approval of the nation. It was not that Professor Henry despised literature that he did not favor the attempt to found a splendid library, for few men were more sensitive to its charms or appreciative of its powers; much less that he did not understand the value of a museum to an ardent interest in which he was pledged by his fondness for natural history and his curious zeal in ethnology and archæology, but because he saw a need and opportunity for an institution that should be limited to the increase and diffusion of scientific knowledge. *Finis coronat opus.* The experiment has justified the theory. Not only have the workings of the Smithsonian Institution vindicated the wisdom of his anticipations, but it is itself a monument to his strong convictions and his unyielding tenacity, tempered as these were by singular simplicity, patience, and unselfishness. Had it not been for these characteristics the Smithsonian Institution as we know it would never have existed at all. Were it not for the modesty of the man we would hear this statue speak as it surveys the scene of his life work, "*Si monumentum quæris, circumspice.*"

Then showing that the library, the museum, and the art collection had thrived better than if Professor Henry's policy had failed, the orator continued:

"It would not have been surprising if his scientific ardor had thereby been cooled, his invention had been limited, and his many-sidedness had been curtailed. This does not seem to have been true. From the beginning to the end of these more than thirty years he was almost as inventive, ingenious, alert, and wide-minded as when he achieved the triumphs of his early manhood. Though many of his discoveries and inventions were in the line of his official responsibilties, they all bore the stamp of scientific genius. During all this period it should be remembered the sciences of nature were making a progress such as the world had never witnessed before—progress in every form, from the severest mathemat-

ical analysis, through ever-ascending steps of adventurous speculation, up to the most gorgeous cloudlands of theory. Experiment, too, had never made such daring ventures, whether in the form of applications to art, or the determination of problems purely scientific. With every one of these onward movements, whether of theory or experiment, Professor Henry was in active sympathy. In many of the most important he was the leader of thought and act, as witness his place in the very first anticipation of the doctrine of correlation of forces; his prophetic experiments and suggestions in respect to the use of the telegraph in meteorological observations and the reports of astronomical discovery; his devices to render available the reports and essays, scattered over the scientific world, by systematized bibliography; the long-continued researches in respect to light and sound, which were incidental to his official experiments as a member of the light-house board; his comprehensive experiments in respect to the sustaining capacity of building stone, and his never-ceasing study of acoustics in every possible production, prolongation, and disturbance of sound, whether in his own parlor, in solitary walks, in fog or sunshine, or in travel by land or sea."

Briefly alluding to the dark days of the war and the lofty bearing of Henry during that period, which lifted him above personal bitterness from any man, the orator dwelt on the singleness of purpose actuating the Secretary of the institution. That singleness of purpose lifted him above jealousy, envy, and even the idea of a reasonable compensation for his labors. He never directly or indirectly sought for place or honor, nor even asked for increase of pay. Continuing, the orator said:

"In the wars of theory against theory he was recognized as an upright mediator, who thoroughly understood the criteria by which scientific truth can be established, and would impartially apply them. If political, or ethical, or theological traditions seemed to conflict with established scientific principles or facts, he calmly awaited the issue, and insisted that science must have its rights, whatever might be the consequence to any received ethical or theological interpretations. Though his own faith was fixed and fervent in respect to the leading Christian verities, he scorned, with all the energy of scientific integrity, to apply these convictions as a test to any question that was properly scientific. It would have been strange in a man who was always learning something new, had he not modified his views of objective and practical Christian truth with the progress of his mind and his manhood, but he would never acknowledge any base compromise of sentimentalism, or mysticism, or one-eyed dogmatism, with the processes or conclusions of his scientific thoughts. Within the domain of science proper he was a clear-eyed, impersonal, and uncompromising arbiter and judge. Theorists might complain, dogmatists might rage, zealots might bemoan, but not one of them would dare accuse the judge of an ignorant or partisan decision.

For all these high and varied functions, in his high position, Professor Henry had one supreme advantage, in that he had not only studied and mastered so many of the sciences of nature, but that he made science itself, in its principles and processes, the subject of his profoundest reflection. We have abundant evidence

that from the time when he made his earliest ciscoveries his mind was not content to search after the secrets of nature without, but was equally curious to discover the secret of the processes by which man interprets the forces and laws which nature hides with such studious reserve. From the time when he began at Princeton till the end of his life, this was prominently and avowedly the theme of his constant meditation. In making this a study he was not singular among eminent scientists, but only in that from the beginning to the end this seemed to haunt him as the most wonderful problem of all. This habit forced him to contemplate all the sciences of nature as an organic whole, having intimate relations that are broader and deeper than those which are limited to any single class of phenomena. It forced him to study and question most closely the process of knowledge, the sublimest and most fundamental phenomenon in nature, that he might know how far to trust its products, and by what criteria to test its conclusions. We find evidence of this habit of mind in the questions which he suggests in his earlier essays, and in the partial solutions which he gives in his miscellaneous writings. Such a habit would insensibly train him to exalt the human intellect in its higher functions, with its principles and laws, its axioms and institutions, its theories and anticipations, its forecasting questionings, its creative hypotheses, its tentative theories, and its decisive experiments, and to assure himself that an agent or agency such as this could have no affinity with matter and own no allegiance with physical laws. Even the suggestion that the thinking agency which interprets the universe by authoritative question and answer could once have slumbered in a fiery cloud, or could have been evolved from any material mind-stuff by any series of physical processes, however daintily phrased, seems never to have been entertained by him for an instant as having the semblance of scientific probability. And yet there is abundant evidence from his writings, both early and late, that he was in no sense behind the times, or ignorant of the fasci. nating plausibilities of the newest and most fantastic of theories. While he was almost the earliest in the field to formulate and defend the doctrine of the correlation of forces, and to concede that it might be applied to all the processes that are properly physiological, he was equally sharp and positive in the assertion tha mental agencies of every kind cannot be the correlate of any physical agency but are simply directive. He insisted, with equal positiveness, that the so-called vital force cannot be the product of any mechanical or chemical activity, single or in combination, but must be a directive or constructive agent of itself. Later in life he recognized the manifold indications of the presence of a law of progressive variation in the history of animal and vegetable life, and so far accepted evolution as a working hypothesis. But had he been asked at any time whether evolution as a force, or evolution as a law, one or both, apart or together, could explain the origin of life or living men with intellect and will, and the capacity for science and faith in science, I think he would have regarded the question somewhat as though he had been asked whether he believed in the vortices of Descartes, or Kepler's directing angels. Had this doctrine been defended in a scientific association, either in the soaring gyrations of winged speech, or the dry assertions of

dogmatic positiveness, I am confident he would have remanded its champions at once to the blackboard, and have begged them first to explain whether evolution were an agent, a force, or a law, and desired them to identify it if it were a force, or to formulate it if it were a law. Large as was the sphere which he assigned to the imagination, and important as the role which he allowed to hypothesis, he would bring every theory, however brilliant and plausible, to the triple test of coherence, sufficiency, and experiment.

Forward and hopeful as he had been all his life long to follow the fruitful suggestions of analogy, he never would allow this winged steed to traverse the chasms of scientific theory with any flying leaps, without insisting that it should fold and pack its pinions and then carefully retrace its steps over that hard pathway of fact and law which alone can carry us safely from a scientific hypothesis to a scientific truth. The science of America owes somewhat to his example and authority in this regard, that its brilliant promises and solid achievements have been so far kept free from the speculative audacities and the physiological cosmogonies from which the science of England and Germany has not been wholly exempt.

This, be it observed, was his position within the domains of pure science. For the region beyond, whether it is called the domain of philosophy or the domain of faith, let it suffice to say that he had too positive a respect for his own mind to doubt for an instant that this intellect was the reflex of that supreme intellect which sustains and controls the universe which the scientist interprets. The existence of a personal God was accepted by him as a well-nigh self-evident truth, as necessary to our confidence in scientific study as to our hopes for man's social and moral well being. The moral and spiritual capacities and destiny of man were regarded as dominant facts and chief ends of the universe made up of spirit and matter, facts and ends so important and so pressing as to create the need and establish the truth of the Christian's faith and hope. He believed, moreover, in no inherent law of progress in human nature or human society as such. On the contrary, he asserted often that our supreme hope of such progress, even in scientific culture and achievement, must rest on moral integrity and culture as the supreme conditions."

The orator then dwelt on Henry's fixed idea that immorality is incompatible with the exercise of great mental power in scientific research. He had proposed to prepare a paper for the Philosophical Society on the relations of religion and science, and also upon the true import of prayer. This, however, he was not permitted to do. But he believed in and found joy in prayer. Almost his last words were: "Upon Jesus Christ, the one who for God affiliates himself with men, I rest my faith and hope!" He concluded with the following peroration:

"For more than fifty years, the most memorable and critical which the sciences of nature have ever seen, he has been indeed a guiding star to their devotees in all this land, ever shining with a severe yet commanding light.

During the critical years of its young and buoyant life American science has found much of the guidance and inspiration which it needed in his childlike yet

kindly spirit. And now as it rejoices in the security of its position, and its ever increasing honors, it is most fitting that its assembled representatives should here gratefully acknowledge their obligations to their eminent benefactor and distinguished leader, and cordially welcome this statue, which by its commanding presence gives new dignity to the grounds so long honored by his presence and associated with his name. Long may it stand to express to them and to other generations the sturdy self-confidence, the keen insight, the benignant spirit, the soaring yet docile genius, the self-relying yet devout temper which made him a leader and commander in their conquering hosts. And as here by day and by night, in sunshine and in storm, our honored friend shall ever, as in his lifetime, keep watch and guard over the scene of his cares and labors, of his conflicts and triumphs, so may his memory be kept in fresh and grateful recollection by the coming generations. And as this Institution, so eminently the creation of his mind, shall become more and more busy in its activities, and more and more conspicuous in its usefulness and its fame, may the spirit of its eminent originator continue to inspire its aims, and direct its counsels to the strength and glory of the nation and the well-being of man.

"To the well being of man." For let us never forget that science knows no nationality; least of all in this place, and in this institution, which was the gift from the mother to the daughter land, whose sacred trust and solemn duty has ever been, as it ever should be, to promote "the increase and diffusion of knowledge among men."

President Porter was frequently interrupted by applause as he eloquently depicted the life and character of the distinguished scientist. At the conclusion of his address he was greeted and congratulated by Chief Justice Waite and a number of other eminent men, among whom were the General of the army, the Commissioner of agriculture, Secretaries Teller and Lincoln, Representatives Kasson and Pettibone, the Civil Service commissioners, and many others.

During the congratulations the marine band executed "Schiller," a grand triumphal march by Meyerbeer, and the exercises were concluded.

EDUCATION.

NATURE STUDIES FOR THE YOUNG.

PROF. S. H. TROWBRIDGE, GLASGOW, MO.

One of the peculiarities of the Yankee character is its fondness for whittling. Having a sufficiency of Yankee blood in my veins, I yield to its natural tendency and attempt to whittle out a tooth-pick. I take two square pieces of pine board and a sharp jack-knife, and begin. I saw off five thin slips from the end

of one piece and carefully essay to whittle it to a point. I find, in spite of my best efforts, that, just as soon as it begins to approach a point, it breaks square off and, instead of the desired acuteness, nothing but a blunt end appears. I try another and another with the same result till the whole block is used up and, after all, have failed to make a single sharp point, and, of course, have no tooth-picks. Undaunted, I take the other block and split it *with the grain* into just as many strips as I sawed off before. Now, with much less care in working and in much less time, I have made five neat, uniformly tapering, sharp, symmetrical, effective tooth-picks. Why, now, did I succeed with the last lot and signally fail with the first? The answer, obvious and conclusive, is that in the first case I went the wrong way to work; I tried to sharpen the sticks across the grain.

If I understand the teacher's work, it is primarily to sharpen and make effective for the future use the minds of his pupils. And according to the best of my observation and experience, most have, in the main, gone the wrong way to work. They have tried to work the material across the grain. Now, obviously, the first thing to consider in making the tooth-picks was the best way of working the pine. Equally obvious is it that the first consideration of the intellect sharpener is to know something of the material with and upon which he has to work. What is the bent of mind he has to sharpen? What is the natural order of mental development? What are the first things that attract the attention of the opening mind? Are they definitions, rules, principles; or are they facts? There is clearly but one answer. As facts, are they conceived or perceived? Are they presented to the mind from within or from without? Do they affect his consciousness or his senses? When does a child's education begin?

The first things that attract the attention of children are the objects and events of nature which they see everywhere about them. And their first inquiries are for information concerning the *what*, the *how* and the *why* of those phenomena which affect their five senses. Every child is born a naturalist; and, if his laudable curiosity is encouraged and his questions receive clear and helpful answers, he will soon become delightfully interested in his original investigations, which, in all his life, will be an inexhaustible source of pleasure and profit. By thus habitually using his eyes and thinking of what his sight reveals, he will be continually learning, and *without a conscious effort*, the facts of nature, then their relations to one another, and, in time, the laws which regulate them, and, even before he realizes it, he will be doing valuable scientific work. An excellent educator, Prof. E. S. Morse, says: "To collect in the field, to make a cabinet, and then to examine and study the specimens collected, are the three stages that naturalists, with few exceptions, have passed through in their boyhood." At the same time he will be finding enjoyment richer, purer and more exalting than mere amusement, and will be attracted from much of the mischief Satan finds for idle hands. If much of the money and time spent in procuring toys and games for *amusing* the young were employed in teaching them to enjoy the objects of nature many of which are always present and cost nothing, it would result in present and life-long advantage to the child, and would relieve the fond parent of many

an imploring and perplexing cry—"Mamma, what can I do now?" and much of the sleepless anxiety over wayward children in later years. "As the twig is bent, the tree's inclined."

A most pressing need of every child, as his opening mind begins to inquire into the mysteries of nature, is some one at hand to encourage his inquiring spirit by judicious and well-directed assistance, and to stimulate his mind to an activity which will increase and strengthen through life. Those who know enough of nature to teach it properly to the young, and to encourage them to *acquire the habit of observation*, are justly said to be a desperate need of the present age. But how soon are their childish inquiries on these points rebuked,—often with the command to cease their troublesome questions,—and thus their innate curiosity, which is only a thirst for knowledge, is checked, their youthful ardor with its mental stimulus changed to indifference and often to *stupidity*, because those who should give the help needed are unable to do so. The real and only practicable remedy is in the ability of the parent to give the child the help he craves. In the absence of this, his next best recourse for assistance is to his teacher. But how or where is either parent or teacher to acquire the ability? If not at home, then certainly at school, if at all. And educational institutions of all kinds which do not supply this lack are manifestly remiss in a most essential line of work.

Does a child's education commence when he first begins to learn from books? According to the present method of reversing the order of nature, it is far more likely to *end* there, and to be henceforth nothing but a servile acceptance, for absolute and unquestioned truth, of the statements and opinions of text book and teacher. Every teacher who has honestly endeavored to *educate* his pupils, in the proper sense of the term, has been painfully impressed with the fact that the first, and usually the last and only, effort of nine-tenths if not of ninety-nine hundredths of his pupils, to whom he has given a question requiring independent thought and the use ot *their own* eyes and minds, is to seek help from the printed page; this failing, the parent or teacher, the big brother or sister, is implored to impart the needed information. If these fail the pupil is sure he has exhausted every conceivable resource, and confidently gives the all-conclusive reply: "I can't answer that question because I couldn't find it in the book, and mamma didn't know." Or if he propounds a question requiring individual study to an adult Bible-class, the first response, if not the only one, is likely to be: "What do *you* think about it?" or "I will look it up in the commentary."

The bane of the education system of to day is its obsequious subserviency to authority. The popular craving to be imposed upon is an attractive demand which many hasten to supply; and the rich abundance of both supply and demand react upon each other and both to an alarming extent are thereby increased. And I lay largely at the door of the common method of exclusive text-book and lecture instruction in various branches, and especially in the natural sciences, with its servility to the words and opinions of the author, without personal investigation or inquiry, and the cramming of undigested and indigestible statements

into the young mind, the fact that the popular world to-day is overwhelmed with a deluge, vaster and more universal than Noah's, of crude suppositions and wild theories which are turning the world upside down. And it can never be set right till young and old have learned to be fully persuaded in *their own* minds—not in another's, and to prove all things by individual, independent thought.

Now how can this independence of mind be best acquired? This question suggests a consideration of the relative value of studies usually pursued. Did space permit, it would not be difficult to show that, while all are valuable and none can be entirely dispensed with, the best results in furtherance of *every* legitimate design of school instruction are to be looked for in the realm of nature studies; and that these ought to have, through the whole course of school and college instruction, and especially in the early part of each, *at least* as much time and attention as any other branch of study.

The time one can devote to educational pursuits—which during the time are unproductive—is, at best, but short. And, if we accept the statements of those who ought to know, its brevity is increasing. In other words, the "ratio of graduates to our population is continually diminishing." This decline, which is a sad one for the educational interests of our land, is attributable to the fact that the education of to-day does not keep pace with the demands of practical life. If we would have our people receive a thorough education, we must establish a closer relationship between the studies of the schools and the pursuits of every-day life. This has been forcibly urged by such educators as Winchell, Youmans, Dawson, Spencer, and others; and there is still need of the continual rubbing that shall at length wear away the ruts in which educational methods have run from primeval times.

Of course, the shorter the time one can spend for his education the more imperative the demand for such studies from the start as will be of most advantage to him in after life. But we hear on every hand the statement that every pupil *must have* reading, spelling, geography, grammar, arithmetic, history, some ancient and modern languages, a little music and art, and with these indispensables they have no time for such such superfluities as scientific studies. Is this system based upon the soundest reason from our present stand-point of observation? If it was best in times long past this does not prove it the best now; but rather, if the times have changed the probabilities are that the *demands* of the times have changed also.

Passing over other points of inquiry respecting the benefits of nature studies, let us spend a few minutes upon the two questions most prominent in ideas of education: (1) as to their value for strengthening and sharpening the intellect and (2) their practical use, as compared with other studies.

As a means of intellectual culture science has no superior. The first requisite to success in any line of effort is *interest* in it. The attractiveness of natural objects and the peculiar fascination in the study of nature, to all who have learned to *see* these things, afford a degree of interest and mental quickening which is found in no other studies. Ancient classics and mathematics *have been* considered

superior to all other means in mental discipline. Advocates of the Greek and Latin languages "claim that their disciplinal value is in the ratio of the naked retentive power which they call into exercise." Without detracting in the least from these, we simply ask what can be a greater tax upon the memory than to retain the names, classification, structure, and habits of the hundreds of thousands of animals and plants upon the earth? It is also claimed that language disciplines memory and strengthens judgment by a study of its grammatical structure. But does it require more of the mental effort that promotes these than does the determination of minerals, the analysis of complex chemical substances, or the determination of the proper position in the scale of life to which any animal or plant belongs, or the exact horizon of a disputed stratum of rocks? The study of mathematics has the credit, and justly too, of giving great power to the reasoning faculties. But whether it is superior in this regard to what is called moral reasoning, admits of question. What can require greater depth of thought or strength of reason than to study out the plan of God in forming and controlling the material universe? The study of nature has for its object the solution of this great problem with all its corollaries. What problem or problems in mathematics can require more profound research? Mathematics is generally regarded as dealing with facts upon which the mind can rest; but scientific reasoning is more a balancing of probabilities. The latter requires constant exercise of reason and judgment to see that the opinion held has a preponderance of probabilities in its favor; while the former demands less mental exertion and hence affords less intellectual power.

Again, the notion is manifestly prevalent that geography, grammar, reading, spelling, the classics, and especially mathematics, are of more practical use than science to the majority of mankind. That they are of use to all, and in more and higher ways than is commonly supposed, and that science is one of the largest beneficiaries, is gratefully admitted. But in the ordinary acceptation of their use in common life, we beg in all candor to know and challenge a satisfactory answer, what real use ninety-nine in every hundred have for any more of mathematics than the four fundamental rules of arithmetic, or of classics than can be obtained from an unabridged English dictionary and a literal translation; and what real use nine hundred and ninety-nine in every thousand have for more of mathematics than can be found in an intermediate arithmetic, or of ancient classics than can be acquired in a single year; also how much *real proficiency* any one attains in geography, grammar, history, reading, spelling, and the like till after he has left school and finds a need of a thorough knowledge of these things in the practical affairs of life? Who, except those who have never tested it, has any reasonable expectation of obtaining a satisfactory solution of a question requiring independent thought, or even the correct statement of a fact, on any of these subjects, from those yet in school, who have there glibly recited the principles involved over and over again?

The growing popularity of natural science, at least among those who give any adequate consideration to its claims, its increasing value and demand in all

walks of practical life, and the long array of questions of deep, and many of vital, importance which it has to solve, sufficiently demonstrate its importance to every thoughtful mind.

Many of the blessings of science are so common that we forget to be thankful to any source of good for them. To make us fully appreciate the value of a simple pine stick with sulphur and phosphorus on its end, we need to go back to the days of the tinder-box, to lose the last match in a vain endeavor to start fire in a far-off camp, or to be compelled, as was its inventor, to suffer the "gravest inconvenience from his tedious efforts to obtain a light from flint and steel" while preparing chemical lectures at four o'clock on winter mornings. Before we can realize how much we owe to science, we need to lose, for a time, the benefits of chimneys, pumps, time-keepers, glass and earthen-ware, coins and other alloys, bleaching, illuminating gas, all kinds of machines, from the pin to the steam-engine, applied science in arts and manufactures, and other indispensables without number which science has given us. Most of the inventions which are now gaining wealth for the inventors and the public are made by application of the principles of physical science to the varied and rapidly increasing wants of man. And those who fully understand these principles are the ones to whom we reasonably look for the discoveries and inventions which are to benefit, enrich and bless mankind.

A critical inspection of the later and somewhat less popularly understood benefits derived from each branch of natural science, might add to the strength of this discussion, especially those in the line of electricity, of mining and agriculture, and particularly in relation to the ravages of insects upon crops, and their remedies; but space forbids.

But it may be said that science studies in schools have not shown the good results that are claimed for them. This is true, and the reasons for it are clearly seen. In the first place they have not had a fair chance. They have had far less time and attention than other studies. As a rule school boards, teachers, parents and pupils have a lower appreiation of nature studies, and less interest in them than their importance demands. On looking at the facts in the case, this is not at all surprising. One's interest in any subject is just in proportion to what he knows of it and does for it. The chances are against a fair acquaintance with science from the simple fact that so few schools, comparatively, teach it by the only method by which it can be learned. Again, if a teacher has been so fortunate as to have learned as much of these as of other studies, and enough to see somewhat of their rare attractiveness and value, he will find few positions in schools of any grade, especially in the West and South, in which he will not be expected to teach more or less of all branches of study in the school course; and, if he is sufficiently interested in any one study to thoroughly master it, he will have neither time nor inclination to master others. Or, briefly stated, the chances are against his choosing science as a specialty, and if he does he will be practically forbidden to give it special prominence. Science in schools must, therefore, be an underling till teachers of science refuse to waste their own time and that of

their pupils in attempting to teach what they have no time or taste to thoroughly understand. All education must suffer till a judicious division of mental labor will neither require nor allow one to teach these topics for which he has not himself sufficient enthusiasm to inspire his pupils.

Another reason for the too prevalent notion that what is in reality the most charming line of study is the most dry and void of interest, is that these subjects are taken up so late in the course of study that the pupil never acquires the scientific method. He is set to learning definitions, laws and principles before he has been allowed to see any basis in fact and reason for them; compelled to accept the conclusion before he has considered the premises; and to crowd the memory with long lists of hard names relating to objects of which he has no intelligent conception, because he has never seen or carefully examined them.

Again, when science *has been* accorded its fair share of opportunities, these have, for the most part, been practically wasted by *wrong methods*. It is a sad mistake, though I believe a ruinously common one, to think the teacher's work is to impart information. The teacher ought not so much to be a good conductor as a good exciter or electric. The parent does not best serve his child when he hands from his own purse whatever the boy wants; but rather he who with holds every possible cent which the boy can earn for himself, and bestows the most precious gift when he teaches him to earn his own money. The history of great men is of those whom some circumstance—usually poverty—had compelled to help themselves. And I believe the best teacher is the one who imparts only the least possible information that will inspire and foster thought, and only helps his pupil to think and acquire for himself. A stuffed turkey is not remarkable for intellectual power, but is about as much so as a stuffed boy, and certainly far more agreeable to a cultivated taste. A porker once chewed up for a friend of mine a leather purse containing $300.00 in bills of his own hard earnings. It made just about as much fat on the hog's ribs as 300 thoroughly digested and well-put statements from a teacher would benefit an ordinary school boy. That which costs one nothing is no more a good to him than the funds which others have earned serve to enrich a cashier who receives without appropriating them.

One can progress more rapidly to carry a child than to teach it to walk. To answer a question or solve a problem for a pupil is easier than to lead him on to his own solution. But the quicker and easier way only weakens the child by fostering the spirit and practice of dependence. Again there is a strong temptation ever besetting a self-conscious teacher,—and it might well be called his easily besetting sin,—to exhibit on every occasion his own superior knowledge, by putting forth his own views before his pupils are given a moment's time to reach a conclusion for themselves. By thus robbing them of the opportunity to form an opinion of their own, he does his pupils an irrepairable wrong. All honor and praise are due to the rare virtue of an instructor with a self-forgetful devotion to the best interests of his pupils which allows them to think by with holding his own thoughts.

The best educators of to-day are thoroughly convinced that a knowledge of

science never was and never will be acquired from books alone. The *only* way to become acquainted with nature is to study ***nature herself.*** I would as soon expect to fall in love with a character in a yellow-backed novel, from reading it, as with nature by reading what others have seen and thought about her. What sort of an idea would you get of a gorgeous sunset, a magnificent landscape, or a soul-inspiring orchestra from a finely written description of it? A blind man was once asked to give his idea of how the sun looked. He replied: "I think it must look like the sound of a very large bell." And his idea, obtained from the descriptions of others, was about as correct as one forms of nature who has never learned to see her with his own eyes.

Now compare this, by an illustration or two, with the method of teaching in other lines of study. To teach arithmetic as science is usually taught, you would have to do away with blackboard and crayon, slate, paper, pencils, cubes, spheres, and every appliance now used to give the pupil a sense-perception of the principles he studies. You would allow the student to waste no time in illustrating the rules by working problems, or money for slate and pencil. If as many school officials were liberal enough to furnish a blackboard in the class-room and time to use it as now furnish apparatus for chemistry and natural philosophy, the *teacher* in these few favored schools might work out a few problems *for the class*, but they must not prove or demonstrate a single rule for themselves. It would cost too much. Now, if you apply the cost, small as it is, of slates, scratch-books, pencils, boards, crayons, etc., used by an arithmetic class in a single year, to procuring apparatus and specimens for a class in science, you would see a wide difference in the appreciation and interest given to science, and by attempting to teach arithmetic a year without illustration, would be better able to see the relative disadvantage under which science is compelled to labor.

Take another illustration, perhaps less appropriate, but more striking, in the case of music. Imagine a music teacher pleading with the school authorities for an instrument to illustrate the musical sounds he explains to his class, even begging the boon of a tuning fork, and the students acquiring a "*thorough knowledge*" of music without either, and you may gain some idea of the attempt to teach science "*thoroughly*" with no illustrations; and abundant explanation of the low esteem in which nature studies are held in so many schools. Fancy for a moment a music teacher attempting to interest and perfect a large class of pupils (he usually teaches one at a time) in instrumental music, with only the music book and oral instruction! He would proceed somewhat thus: These marks, called notes, indicate different sounds. You must learn their names first, do, ra, mi, &c. This note is higher than that, this higher still, the next still higher, and so on, and this eighth note is an octave higher than the first. This note is twice as long as that, half as long as the next, quarter as long as the other. This scale is divided into feet or measures and there are four beats to the measure. This tune begins on a different note from that, which makes it in a different key, and that makes it sound diffierently from the other. Now you must learn to read these all

correctly, call them by their proper names, tell how much each note is higher than the others and how long time each one must take. When you can do this for every tune in this book you can finish it and go through a higher book in the same way. But one bright pupil says:

I don't see any sense in it at all. I don't understand what you mean by higher and longer notes, an octave, the scale, the beats, and the measure, and don't see how I can remember the names and kinds of so many different characters. The teacher says:

Oh! it is a most delightful study. When these tunes are played they make most heavenly music, and it is worth a great deal to you.

Student.—I wish I could hear some of them played.

Teacher.—Yes, it would be better if you could.

S.—Why can't I?

T.—We would need a piano for that.

S.—Can I ever understand music without one?

T.—Not very well, but they cost a good deal of money and the school can't afford to buy one.

S.—Then I will go to a school that can afford one.

She goes; and finds the teacher with a good instrument. She now understands that there *is* something quite interesting in the notes and tunes when the teacher illustrates them by playing on the instrument. She, being an exceptionally thoughtful and aspiring person, thinks she would like to know how to play for herself. The teacher raises his hands in holy horror with the astonished exclamation that she would get the piano out of tune, break the strings and the keys, injure the pedal, and positively declares this is only for the teacher to use.

But says she: Can I ever understand music to do me any good unless I learn to play myself? Did you learn without a piano to use?

Teacher.—No I didn't, and you can't, but the school has made no provision for practical exercises by the pupils themselves. All you can get here is the privilege of hearing me play and of having the principles taught you.

Her desire to secure some satisfactory benefit from her expenditure of money, time and effort, determines her to seek a school in which she can have a piano for her own practice. She succeeds; and soon learns that, to become at all proficient, she must have a piano of her own to which she can have access at all times.

This is what it costs to gain proficiency in music, and no plea of want of funds would for a moment excuse any school for attempting to teach music without the necessary outlay. To place science on an equal footing with this accomplishment, each pupil should have his own set of apparatus, illustrative series of specimens and preparations a good cabinet, microscopes and other essentials to his work, in his own home and at his own disposal. This would make in the aggregate a considerable outlay of money; but probably not so much as is expended for excellence in instrumental music, and this is retained only at the additional expense of constant practice. Yet science, in nine schools out of ten,

must be taught with hardly a dollar of expenditure, and the teacher who is not willing to teach it in this way is promptly replaced by one who is. Is it at all strange, under these circumstances, that science is not appreciated?

Fortunately, however, one does not need an immense outlay of funds to possess respectable facilities for teaching nature. The material is to be found everywhere and costs little beside the effort to bring it together, *and*—an important consideration—the ability to see instruction in it and to arrange it for the instruction of others. The text-book too is always open to all who can "interpret the mystical hand-writing there," and no book-dealer has a monopoly on it or can shut it from your view. In the face of these facts, it seems strange indeed that so few public or private schools are at all adequately supplied with preparations, systematic collections, and the like, for teaching nature in the only way those who know it best say it can be learned. True, some schools have a few appliances for illustrating natural philosophy, and a smaller number, for chemistry; but ruinously few facilities are to be found for teaching any strictly natural history studies, though these are most easily obtained and their acquaintance more sadly needed than any others.

THE PUBLIC SCHOOL PROBLEM.

E. R. KNOWLES.

In this country all discussions of problems relating to government education have unfortunately been heretofore participated in either by politicians desirous of turning the bigotry and ignorant prejudices of some of their fellow citizens into political capital for themselves, or by persons whose narrow sectarianism and absurd fears have led them into a one-sided view of their theme and caused them to flee blindly from some imaginary evil into the presence of a real danger, rather than considered in a truly liberal, intelligent manner with a desire to ascertain that solution of the problem which will be the most conducive to the welfare of the American people, as a whole, and which shall be founded on the basis of equal justice to all.

As republicans, the citizens of the United States will not allow the public servants to infringe upon their rights. This is one of those recognized American principles that will never allow our people to tolerate a sectarian public school system. Our people seek "equal rights for all, favors for none." The liberty of conscience of Catholic, Protestant, Jew, free-thinker and infidel must, under the national constitution, be equally respected. Though among the "reserved" State powers is that of dealing with religion and the religious liberties of the people in such manner as each State shall think most expedient; yet we find the doctrine fully expressed in the Constitution of thirty-five States, and implied in the Constitution of two others, that the consciences of all shall stand on the same footing, and that religious liberty must be secured for all the people.

It is alike impossible for the upholders of religious liberty to consistently require the children of our States to attend, and the tax-payers to support, schools where the Protestant Bible, which is regarded by Roman Catholics, Jews, and others as a sectarian book, is read, or where the tenets of the Catholic, Jewish, or any other faith are taught. Therefore, if we have any public school fund, and it is not distributed in part among the religious bodies to be used by them for the support of their own denominational schools, the State should rigidly confine its system of popular education to the secular sphere of knowledge.

But a secularist public school system does injustice to all who have any Christian convictions, and tends to sap the foundations of public morality. The consciences of all citizens have an equal, natural, and constitutional right to be respected, and a secularist public school system which is thus an outrage to millions of American consciences, not merely because it excludes religious teaching altogether, but because it produces a vicious, immoral, thriftless, and superficially educated class of citizens, with an education sufficient to do them harm, but not complete enough to do them any good, is a violation of right and a disgrace to the country. It is a violation of right that any person having any Christian convictions should be compelled to pay taxes for the support of such schools.

A very large number of the children who now attend our public schools are so situated that all the improvement and instruction they get must come only from their attendance at school, and, as Washington said, "Reason and experience forbid us to expect that national morality can prevail in exclusion of religious principle." This class of children cannot be expected to become men and women of good moral character. As to the rest of those who attend these schools, it is useless to say that their religious education can be secured by exertions in the Sunday-school and at home. The evil influence of the secularist public schools will thwart and nullify the efforts of good parents toward this end. Even those who inveigh against the opponents of a public school system are seldom willing, when they can afford to pay the charges of a private school, or can avail themselves of the privileges of a parochial school, to risk the danger of having the breeding and morals of their children contaminated by their mingling with children from the most rude and immoral quarters of society in schools where not even the first principles of Christianity and morality are taught. Such Godless schools ought to be abolished on account of their pernicious influence.

The term Godless, applied to the secularist public schools, here means the same as anti-religious, immoral, and hostile to true religion; and such the public school must be, unless it makes religious teaching one of its functions; not because true religion will not stand the test of popular enlightenment (if that were the case the sooner the world got rid of it the better); but because, as I have already urged, morality cannot prevail in exclusion of religious principle, and the indifference to and ignorance of religion among those who are trained in these schools, and especially the bad examples and influences there met with, lead to immorality and every sort of corruption.

A system which excludes altogether religious ideas from its instruction gives

to the children of its schools the practical example of "religious indifferentism," which is sure to bear, sooner or later, its usual fruit of infidelity, knavery, and debauchery.

Can these evils of a public school system be remedied by the distribution of the public money, either the whole or a part of it, among the religious bodies, to be used by them for the support of their own schools? If this plan were adopted the expense of supporting the public schools would become greater even than that of supporting a secularist public school system, because this plan requires an unnecessary increase of "machinery;" and if the number of children taught by each denomination respectively was in the same proportion to the total number of children taught in the public schools, as the tax paid by such denomination to the entire amount raised by taxation for the support of the public school system, it would amount to the same thing in the result as the voluntary plan of popular education, except that it would be far more expensive. But when the number of children taught by the several denominations respectively and their respective taxes are greatly disproportionate, the State, through its taxing power becomes the supporter of religious sectarianism, compelling the people to pay the expenses thereof. The State can support sectarianism in the public schools without paying money for the religious instruction given in them. The State, therefore, should have nothing to do with popular education. Among those of any religious belief, complete education and religion are inseparably connected, and when a State, whose citizens comprise chiefly adherents of various creeds, attempts to give the former it necessarily gives instruction in the latter, and does injustice to some or all of the religious bodies among its people.

It is objected that this plan would entirely withdraw educational advantages from a large number of the poorer classes, and would be practically equivalent to a plan for lessening general intelligence. If the Catholics of this country, laboring under great disadvantages and with insufficient means, while at the same time taxed to support sectarian or secularist public schools which they totally disregard, have voluntarily taxed themselves to support parochial schools for the benefit of their children and of all the poor children whom they can gather under their charge, there is certainly nothing to prevent those of other schools of thought from following their example in maintaining their own schools and charitable institutions. And if other religious bodies exert themselves one-half as much as the Catholic Church in the interests of popular education on this voluntary plan, the abolition of the State public school will, at least, not *lessen* general intelligence.

Public schools, therefore, *as State institutions*, should be abolished, and every religious body should have and support its own free schools; where at least good breeding, morality, and the love and fear of God will be imparted, as well as secular learning; this plan being the only solution of the troublesome public school problem, founded on the basis of equal justice to all.

ZOOLOGY.

NOTES ON THE DISTRIBUTION OF SHELLS.—NO. IV.

F. A. SAMPSON, SEDALIA, MO.

A co backward spring made all vegetation unusually late for the date of my trip, and when I left Sedalia on the 12th day of March, 1883, everything here was still almost in winter dress, and showed very slight effects of the returning of spring. A few birds had come, the blue-jay being the first, on the 24th day of January; the blue-birds came on the 20th day of February, though a single one was seen two weeks earlier; and the robins arrived in flocks on the 3d day of March.

My first stop was at Lamar, in Barton County, Missouri, where I had some six hours to wait for a train, and I decided on putting in the time collecting shells, and at once started for the woods. I found, however, that the soil was so sandy as to make land shells scarce. In the bottom along the north fork of Spring River, I found the following:

1. *Zonites arboreus*, Say.
2. *Z. minusculus*, Binn.
3. *Conulus fulvus*, Dr.
4. *Stenotrema leaii*, Ward.
5. *Strobila labyrintkica*, Say.
6. *Pupa contracta*, Say.
7. *P.* ———— ———— (?)
8. *Succinea ovalis*, Gld.
9. *Carychium exiguum*, Say.

Also the following water shells:

10. *Physa gyrina*, Say.
11. *Planorbis trivolvis*, Say.
12. *P. bicarinatus*, Say.
13. *Amnicola porata*, Say.
14. *Sphæreum striatinum*, Lam.
15. *S. transversum*, Say.

I got but three species of *Unios*, though from the shells I saw in some yards in the town, there are other kinds in the streams there.

In a small branch stream, by sifting the mud, I obtained considerable numbers of

16. *Sphæreum* ———— (?)

Of beetles I saw not more than a half dozen species; two or three kinds of

butterflies were on the wing; and turtles were out lazily sunning themselves on logs.

The next day I promised myself fine success around Springfield. I knew of a *Goniobasis* and several rare land shells having been found there, and knowing that there were many springs about the town, I supposed I would find the former in abundance. I first walked to a fine spring near town which had a small fish pond attached to it, but I found less than a half dozen *Physa gyrina*, and no other shells. I then went to some timber on the higher ground, and although there were places suitable for shells hibernating, if there were any, I found none. Afterward Mr. J. R. Milner drove me to various points around the town, but none of the springs visited showed any *Goniobases*, and some of them no other species.

At one, the *Physa gyrina* were fine and very large with no small ones; at another they were quite plenty, of different sizes, the largest seeming to be mature, though not more than one-half to two-thirds the size of the others. In James' Fork of White River, a few miles from the town, *Unios* are said to be plenty.

On a rocky bluff south of the town I expected some success with land shells, but they were very scarce. Under one stone there were a dozen *Stenotrema labrosa*, Bld.; they were 8 mm. in diameter, those from Eureka Springs, Ark., being 11 mm.

The following are all I found there:

1. *Physa gyrina*, Say.
2. *Limnophysa humilis*, Say.
3. *Mesodon clausa*, Say.
4. *Stenotrema labrosa*, Bld.
5. *Pupa armifera*, Say.
6. *P. Contracta*, Say.
7. *P. fallax*, Say.
8. *Zonites arboreus*, Say.
9. *Succinea ovalis*, Gld.

Of beetles I obtained perhaps twenty species.

The crows winter in and around Springfield in large numbers, but before time to build nests they go further north. It is said that there is a narrow strip of country running southwest in Arkansas, in which strip the crows winter, and out of which they are seldom seen during the winter time.

Arriving at Eureka Springs at noon of the 15th, I commenced the same day my conchological pursuits. With Mr. C. C. Allen I first went to a side ravine near the Johnson Spring, where I found the *Polygyra jacksoni* in considerable numbers, they being scattered among the gravel and small stones, and under such circumstances I found them at the different places where collected, while the next species was always found under large stones or logs. There was also a difference in the lay of the ground where the two species were found, the latter being almost the only shell on hill sides having south or west exposures, while the *jacksoni* and other species were found on north and east exposures.

At different points having south and west exposures I found *Polygyra sampsoni*, Wetherby, but they were most abundant on a hill near King's River, where I got fifteen or more under each of five stones. This species varies in size, the larger ones having a much wider umbilicus and being 9 mm. in diameter, while the smaller were not 7 mm. in diameter.

In June and July, 1881, *Physa gyrina* were very plenty near the springs along West Leatherwood Creek, but I now saw but few of them.

At the previous visit a branch stream had *Ancylus tardus* and *Pisidium compressum* (?), in abundance but I could not now find a single one of either. The reason probably is that the bed of the stream is used to some extent for a wagon road.

In 1881 this stream had great numbers of the interesting shell-shaped pupa case of the *Helicopsyche armifera*, Lea, but now scarcely any were seen, while another kind similarly made of grains of sand, but straight, one sided, and affixed to the under side of stones were plenty.

Lizards, as might be expected, were abundant, though I found only one snake during the four days collecting. Under one stone I counted sixteen scorpions.

In King's River I obtained fine large *Pleurocera subulare* and *Goniobasis pallidula*, both of which I got in White River in 1881, but they were quite small in comparison with the King's River specimens.

In the REVIEW for January, 1882, I gave a list of shells found in and around Eureka Springs, and I now give the list as corrected and added to since that time by Mr. C. C. Allen and myself.

1. *Mesodon albolabris*, Say.
2. *M. albolabris, var. alleni*, Wetherby.
3. *M. exoleta, var. minor.*
4. *M. thyroides, var. bucculeuta*, Gld.
5. *M. divesta*, Gld.
6. *M. clausa*, Say.
7. *M. elevata*, Say.
8. *Patula alternata*, Say.
9. *P. solitaria*, Say.
10. *P. perspectiva*, Say.
11. *Stenotrema labrosa*, Bld.
12. *S. leaii*, Ward.
13. *Polygyra jacksoni*, Bld.
14. *P. sampsoni*, Wetherby.
15. *Triodopsis inflecta*, Say.
16. *T. oppressa, var.* Major.
17. *T. fallax, var.* Minor.
18. *Strobila labyrinthica*, Say.
19. *Zonites arboreus*, Say.
20. *Z. fuliginosa*, Griff.

21. *Macrocyclis concava*, Say.
22. *Pupa armifera*, Say.
23. *P. fallax*, Say.
24. *P. contracta*, Say.
25. *Succinea ovalis*, Gld.
26. *S. verrilli*, Bld. (?).
27. *Bulimulus dealbatus*, Say.
28. *Helicina orbiculata*, Say.
29. *Pomatiopsis lapidaria*, Say.
30. *Tebennophorus carobuensis*, Bosc.
31. *Limax campestris*, Binn.
32. *Physa gyrina*, Say.
33. *P. heterostrophe*, Say.
34. *Limnæa humilis*, Say.
35. *Planorbis bicarinatus*, Say.
36. *P. trivolvis*, Say.
37. *Ancylus tardus*, Say.
38. *Melantho integra*, Say.
39. *Pleurocera subulare*, Lea.
40. *Goniobasis pallidula*, Anth.
41. *Sphæreum transversum*, Say.
42. *Pisidium compressum* (?), Prim.

GEOLOGY.

AGE OF THE MISSOURI RIVER.

E. P. WEST.

(*A Paper read before the Kansas City Institute.*)

MR. PRESIDENT AND GENTLEMEN:—The Missouri, one of the grandest rivers of the world, washes the northern limit of Kansas City. We witness its annual floods, garnered by the vast accumulations of winter's snows in the far-off elevations of the Rocky Mountains. We see, year by year, the devastations caused by its wild waste of waters. We observe it, in its gentler moods, freighted with the products of many nations, destined to swell the commerce and add to the convenience and comfort of the enlightened and happy people occupying the environments of its picturesque shores. Generation after generation, age after age, witnesses the same occurrences; and we are apt to associate this great river with the geological formations cut by its turbid waters for all past time. But,

while it is one of the largest, and apparently one of the oldest of rivers, it is, in truth, one of the youngest of this continent. When the St. Lawrence, the Cumberland, the Ohio, and the Upper Mississippi had attained their full growth and supremacy over the countries now tributary to th m, the Missouri River was but in its infancy. When their systems of drainage were complete, all the vast territory now tributary to the Missouri, which lies within the limits of four great geological formations, namely, the Triassic, Jurassic, Cretaceous, and Tertiary, embracing a part of Iowa, the most of the States of Kansas and Nebraska, all of Colorado, and the Territories of Wyoming, Dakota, and Montana, were covered by an ocean. The Missouri River was then but little more than four hundred miles in length, and its drainage covered less than half of Missouri and Iowa, and but a small part of the eastern portions of Kansas and Nebraska, its headwaters being not remote from Omaha, Nebraska. Then great reptiles, from forty to ninety feet in length, sported in this vast expanse of ocean, which, with some interspersed islands, extended westward over the western plains and Rocky Mountain regions, covering the entire country now drained by the Missouri River westward and northwestward of Omaha. The eastern borders of Kansas and Nebraska formed a part of the ocean's eastern shore line, and it was nowhere at a greater distance than two hundred miles from the eastern boundary of these States, the greatest distance being along the Kansas border.

The Triassic and Jurassic formations were the first to emerge from this old western ocean. These formations are exposed along a narrow strip of country extending through Middle Kansas, and prolonged, perhaps, into Eastern Nebraska, but greatly widening to the south-west through the Indian Territory and Northern Texas. They added but little to the drainage of the Missouri River, and are conspicuous for the paucity of organic remains in them. Next, the Cretaceous formation emerged and became dry land. This added to the Missouri's drainage a broad belt of country extending across Kansas and Nebraska, and northward of Omaha, through Dakota Territory, increasing the river's length more than four hundred miles, and adding very materially to its western tributaries. This formation is noted for the great abundance and gigantic proportions of its fossil reptiles and numerous invertebrate forms, as well as for several varieties of fossil wood, leaves, and plants, closely approximating present living species. Lastly, the Tertiary formation rose from the water, completing the Rocky Mountain system, and the drainage of the Missouri River to its present sources. By the uprising of this formation the remainder of Kansas and Nebraska, the most of Colorado, and the Territories of Wyoming, Dakota, and Montana were made tributary to the waters of the Missouri. But we must not associate these various elevations with great catastrophes, or suppose them sudden or violent, but, on the contrary, we have reason to believe them slow and gradual, requiring long ages in their accomplishment. We must not, either, consider the Missouri, though among the youngest of rivers, so very young, counting its age by years, or comparing it, even, with man's duration upon the earth, for it has witnessed stupendous and long-continued changes since it attained its majority and was adopted, full-grown,

into the family of American rivers. Though young in comparison with the other great rivers I have named, some idea of its really very great age may be formed when it is considered that the great and wide-spread mutations which gave it birth and built up our western river systems, occurred between the close of the Carboniferous age and the end of Tertiary time The upper carboniferous rocks are to be found about Kansas City, and northward along the western border of Missouri and eastern borders of Kansas and Nebraska, and the Tertiary formations about the elevations of the Rocky Mountains and over their eastern slopes.

Next in sequence followed the events alluded to as having occurred since the Missouri river was increased to the full measure of its present drainage, namely, the Glacial and Champlain epochs which occurred in Post-Tertiary time. First, the Glacial period was ushered in:

"Once the fierce Kabibonokka,
Issued from his lodge of snow-drifts,
From his home among the icebergs,
And his hair, with snow besprinkled,
Streamed behind him like a river,
Like a black and wintry river,
As he howled and hurried southward,
Over frozen lakes and moorlands."

The entire country now tributary to the Missouri River was elevated far above its present level, and vast glaciers, thousands of feet in thickness, crept down from the northward to about the parallel of Kansas City. But before the country became mantled in snow and creeping rivers of ice, the Missouri River had carved out a channel to an unknown depth, but, perhaps, five hundred feet or more below its present bed. The old channel is found to be choked up with drift-sand and boulders, borne in by glacial action, and by this means the river was partly, and perhaps entirely, diverted in some places. These facts are made apparent by the achievements of modern civil engineering in overcoming obstacles to continuous railway transit. Nine railway bridges now span the Missouri River from Omaha downward to its mouth. All of the bridges approach one or the other of the river bluffs, generally those on the south side. In sinking piers to support the superstructure, solid rock has been found only on one side, *i e.* the side touching the bluffs, although excavations for this purpose were made at all of the bridges, in the river's bed, from sixty to more than one hundred feet deep. Consequently some of the piers, in each instance those most remote from the bluffs, rest on piles driven into the loose erratic material which fills the old channel up to the river's present bed. These facts would seem to indicate that the old gorge of the river extended from bluff to bluff, and sloped, with more or less regularity, downward from the bluff on either side, toward the centre of the valley. It required a great lapse of time for the river to cut out such a channel, and long ages must have transpired between the close of the Tertiary era and the full inauguration of the Glacial epoch, between which events this work of attrition was done.

To comprehend this clearly, we must imagine a rock-bound canyon of variable width, cut through the carboniferous strata between the bluffs on either side of the river, to a depth of five hundred feet or more, below the present bed, at the bottom of which the river was dashed in wild confusion; then we must conceive of vast rivers of ice, creeping down from the north, laden with great streams of stones and sand, to be emptied into the canyon, in quantities sufficient to fill and completely dam it up in many places; but, at the same time, it must be borne in mind that at the interval the glaciers reached the Missouri River the volume of water was greatly diminished in it, in consequence of the congelation of the snow and rainfall over all the country north of the 40° of north latitude.

The Glacial period is distinguished by its wide-spread distribution of eratic rocks over all of the country north of the 40° of north latitude. It has but few fossil remains, and those, mostly of life which preceded it.

The Champlain epoch next followed, and was, in every way, in strong contrast with the Glacial period.

Most of the country along the Missouri River, which, during the Glacial time, had been elevated above the present level, in the Champlain era was sunk below it. Instead of intense cold, the climate was warmer than we now enjoy. Instead of vast fields of moving ice, still lakes prevailed along the Missouri River, co extensive with the Loess formation now bordering it. Instead of an arctic waste, life teemed in the water and upon the land. The lakes were filled with fish, and the land abounded with animals. Among the animals the elephant and the mastodon browsed among the hills and valleys. The horse, much larger than the living species the ox, and the bison grazed on the plains. A gigantic beaver, and animals of the sloth tribe, much larger than the moderns, prevailed. Among the carnivores there were bears, lions, and a species of raccoon; and last, though not least, we have a glimpse of man playing a part for supremacy in this remote era. The remains of several of these animals have been found imbedded in the Loess deposits about Kansas City. This era is distinguished for its great deposits of brick clay, or Loess, its terrace formations, its gigantic mammals which have become extinct, and for the great number of its mollusks, which are identical with living species. Next, the era of mind was ushered in, and is still slowly fulfilling its promise of a higher destiny.

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, April 10, 1883.

Dr. Delaunay publishes a very remarkable work on "Medicine as Practised by Animals." There is less sickness among the latter than with man, and much of the difference may be attributed to the instinct of animals in prescribing for them-

selves when unwell. Instinct in the case of man, frequently leads to his ruin; thus the stomach impels him to eat when the interests of good health counsel him to moderation or abstinence. Animals select instinctively the food which suits them; man, though not devoid of this instinct, rather disregards it. The doctors it seems devote no attention to the tastes of individuals, but which is not the less an invaluable guide. Women feel more keenly the want of food than men, and further, they do not like the same aliments. However, in the various hospices, both sexes are subjected to exactly a common regime. The same fact reigns almost everywhere. Again, children hardly weaned, are placed on adult dietary, strong meat and wine, which are not only unsuitable, but that they dislike.

Dr. Delaunay from the result of inquiries lays down that a child only likes meat when about five years old. He recommends to allow salt, vinegar, etc., to those who prefer such condiments. Taste is the best of guides. Instinct aids animals also in a sanitary point of view; they free themselves from parasites by rolling in dust, mud, etc. The swallow, when one of its young is attacked by vermin, ejects it from the nest to save the rest. When a dog fails in appetite, it eats couch grass, which is at once an emetic and a purge. Cats also eat certain plants for medicinal ends, and so do sheep and cows. Dogs and horses suffering from constipation, will consume fatty substances with avidity, and an animal attacked with chronic rheumatism endeavors to lie always in the sunshine.

Latreille relates that having cut off the antennæ of an ant, its comrades arrived and covered the wound with a liquid secreted from their mouths; the chimpanzee when wounded staunches the bleeding with leaves or grass; an animal with a shattered leg or paw, amputates it with its teeth. Dr. Fredet had a dog stung in the nose by a viper; for several days in succession the dog constantly plunged its head in a stream till cured. Another dog, crushed by a vehicle, remained three weeks in a current of water, where it recovered, food being duly supplied. Cats also, according to Dr. Delaunay, adopt the cold water cure; one has been known to remain during 48 hours under a jet of water. Instinct may thus teach us many lessons.

Sensations have been measured. We know the time which elapses between the moment when the skin is touched and the subject feels that pressure. The transmission of visual and auditory impressions can also be ascertained. Until now it was unknown how long it took for an odor to be perceived. Professor Beaunis, and Dr. Buccola, of Turin, confirms his calculations, affirms that the time which separates the excitation from the sensation of a perfume is in hundredth parts of a second—for ammonia, 37; vinegar, 46; camphor, 50; chloro form, 56; mint, 63; and carbolic acid, 67. The exact moment of perception for musk could not be ascertained. It results, that the perception of odors travels less rapidly than the sensations of hearing and seeing, and somewhat shorter than those of touch.

By the process known as synthesis, chemistry has been able to re-constitute nearly all the substances fabricated by the animal and vegetable organism; thus

have been artificially prepared urea, formic acid, madder and the odoriferous principles of the tonka bean and vanilla. M. Fischer has just obtained two substances which enter so largely into the composition of tea and coffee, theobromine and caffeine. And from what matter does he extract them? From xanthine, a product derived from urine and guano.

Professor Dubois, of the Sorbonne, makes known a new process for the preservation of meat and fruits. It entails neither injections, immersions, nor kindred preliminaries. The aliment is simply enclosed in vapors of ether, or chloroform, or wood alcohol. It is thus the professor has exhibited fruits, meats, and even entire animals conserved during months under bell glasses saturated with ether vapor. On the cessation of the experiment not the slightest trace of putrefaction was observable; there was a notable loss of water, and the latter which escaped was colored red. Even blood, similarly preserved indicated no change, only the globules were contracted. Fruit diminished in weight and presented the color of faded leaves.

M. Moser has discovered a simple and ingenious plan for strengthening and augmenting the tension of an electric telephonic current. He has applied it to the transmission, along a single wire, of music and speech. At the Electrical Exhibition one wire connected the building in the Champs Elysees with the Opera, and served eight receivers. M. Moser has, by means of a single wire laid between the Hippodrome and the place Vendome, a distance of one and one-half miles, fed one hundred receivers with music from that circus. The energy of transmission has thus been extensively augmented This result opens up the question of transmission of electric force. To obtain in the transmission of sound a maximum of strength, currents of high tension must be employed, and the more the current will possess of electro-motive power the more the intensity of the sound will be increased. But in transmission this intensity diminishes through the leakage of the electricity, and each apparatus, each distance, each communicating wire has its characteristic tension and quantity. M. Moser's discovery enables currents of tension and intensity to be selected, and so renders the sounds received more distinct. It is thus that a very audible conversation has been held between Paris and Nancy, a distance of 220 miles.

M. Gaudry reviews the present state of paleontology. Before the Cambrian epoch, we know nothing about the animal life on our planet; it is in the Silurian epoch that the earliest forms of animal life are accessible to our studies; then the trilobites and similar "kings of the sea" seemed organized for defense and preservation rather than for attack. The Devonian epoch corresponds to the development of vertebrate animals; in the carboniferous reptiles multiply, and they swarm also in the secondary strata; in the tertiary birds and mammiferæ develop themselves, while in the quartenary man appears. Such are the general traits of the progress of animal life across the immensity of geologic ages. Respecting the details of this progress it must not be concluded that each cycle of life has been

developed with precision, in one and the same epoch and strata. Investigations prove that such and such a type runs into another over several epochs. There are, furthermore, great inequalities in the duration and prolongation of these types and the "struggle for life" does not receive entire corroboration, since the strongest and the most perfect types are precisely those which have had the shortest destinies. In a word, the paleontologist can distinguish in this grand history of animal existence, types which correspond to epochs, similarly as we allude to the age of Pericles or that of Louis XIV. There appear to be persistent or cosmopolitan types that play the role of permanent reservoirs.

Lead salts enter very largely and against our will into our daily food, drink, and even raiment. Dr. Galippe announces that sulphate of copper is another metal that can be found in our daily bread and vegetables. But blue vitriol it is now believed is not poisonous; that is to say, taken in moderation, such as it exists in wheats and vegetables grown in France. As revealed by the analysis of Dr. Galippe, there is a very respectable "trace" of blue vitriol in these products; from whence does it come? From the soil; the latter has received it from the practice of French farmers since years steeping their *seed* grain in solutions of blue vitriol to kill weevil and similar vermin.

The astronomer Herschel introduced us to lunar men. M. Zaborouski directs our attention to the case of two conscripts, medically examined in 1880. They had caudal appendices, one three-quarters of an inch in length, the other two and a quarter inches. When the latter was raised it fell down of its own accord. Both were malformations. Max Hortels gives a list of nineteen analogous cases. This does not indicate that a man with a tail is a reality; but that a man with an appendix is a phenomenon. Other *lusus naturæ;* in the Yellowstone mountains of America, *male* hares, or what are designated such, suckle their young very frequently. In 1872, M. Courty drew the attention of scientists to a man at Montpellier, whose right breast secreted milk, and that might put a first class wet-nurse into the shade.

M. Manouvrier has conducted some curious experiments to test the relative power of hand-pressure. Men, not belonging to the laboring classes, and aged between 25 and 45, pressed respectively upon an instrument, a kind of dynanometer; the minimum pressure was 84 pounds, and the maximum 187 pounds; there was always a mean difference in favor of the right over the left hand of 22 pounds; while 6½ pounds was the difference between big and little men. The maximum hand-force of women was 97 pounds; the minimum 35 pounds. Small women had invariably stronger hands than large women. Every-day life confirms that.

ARCHÆOLOGY.

EXPLORATION OF ALTAR MOUNDS IN OHIO.

PROF. F. W. PUTNAM.

The group of mounds about which I will speak to-day is situated in Anderson township, Ohio, near the little Miami River, about twenty miles from Cincinnati.

One of the mounds in this group is the center of a circular embankment placed on a small hill. Across the hill, outside the embankment, two wide trenches had been cut to the level of the bottom of the hill, and the earth from the cuts had been used to form a graded way from the top of the hills to the lowlands. From this graded way a low embankment extends, forming a circle over half a mile in diameter, in which were eleven mounds and a large earth circle. Near the earth circle, but outside the large enclosure upon the bank of the river, was another mound, making in all thirteen mounds belonging to this interesting group. In May last, with the assistance of Dr. C. L. Metz and a number of reliable workmen, I began the exploration of this important group of earthworks. After I was obliged to leave the field, the work of exploration was carried on by Dr. Metz, who has been a most conscientious and faithful agent of the museum, and to him we are principally indebted for the important results that have come from the field work, which has extended over a period of several months. To Mr. Turner, the proprietor of the land upon which the group is mainly situated, the museum is indebted for the exclusive right of exploration.

The mound on the hill was five feet high and fifty two feet in diameter. Beneath the sod and two feet of clay was found, in the central portion, a pavement of flat stones, covering a circular enclosure about twenty-five feet in diameter, surrounded by a stone wall two feet ten inches high and about two feet wide. This stone wall enclosed a central tumulus two feet four inches high and twelve feet in diameter, made up of stratified earth and clay, and the space remaining between the tumulus and the stone wall was packed with a mass of gravel. Under the tumulus was found an elongated bed of puddled clay, sunk in the ground, and having a central excavation, which was filled with sand and covered by an altar made of clay, carefully shaped into a basin about four feet in diameter, and burnt hard and red. This altar did not contain any relics. Upon the stone wall enclosing the inner tumulus were two skeletons, one extended, the other having the bones out of the regular order, as if buried in a bundle or re-interred here. In the clay outside the wall several skeletons were found, one of which lay upon a platform of stones. With the skeletons were found copper ornaments, a cop-

per implement, shell beads, and two large sea shells which had been cut to form vessels.

Another mound contained a sort of refuse pile on one side, and under the centre a bed of burnt clay and ashes, containing the fragments of four pottery vessels and several flint knives. The pottery vessels have since been restored, and one proves to be richly ornamented by incised markings forming squares. No sign of the use of the mound for burial was found.

The largest mound of the group was fourteen feet high and fifty feet in diameter, and proved to be one of the most interesting, from the numerous layers composing it, and the rich character of the offerings upon its altar. Beneath the mound, a little to one side of the centre, was an ash-pit six feet deep. This ash-pit is the first ever found beneath a mound. Its contents were similar in character to those in the Madisonville Cemetery, except that it contained fewer implements. The mouth of the ash-pit and the surface of the ground about it were covered with ashes and animal remains. At the other side of the centre of the mound was found the altar of burnt clay. Its base was sunk a little in the ground, and from its top ran off, over the ashes and animal remains, a thin layer of burnt clay.

The altar was about four feet across, and shaped like a basin. On it were a great number of ornaments and three large sheets of mica. The contents of the altar were covered over by a layer of flat stones, and this by layers successively of sand and ashes, sand and loam, gravel, ashes, burnt limestone and clay, clay and charcoal, flat stones, clay, and lastly, the sod covering the surface.

Another mound, nine feet high, covered eighteen ash-pits and contained two altars near together, seeming to have been erected over a large altar. One of these altars contained in its basin many interesting ornaments of shell, mica, and copper, fragments of carved stone and terra cotta images. Partly covering these objects was a layer of pieces of coal (bituminous), and over all this altar was a layer of flat stones, covered by a layer of sand, this extending also across the other altar, upon which only ashes were found. The layer of sand was completely covered by a layer of flat stones, over which were successive layers of ashes and sand, ashes, clay, ashes and charcoal, clay and sod.

Several of the other mounds were also erected in layers and covered altars. The mound on the river bank was of especial interest, from the fact that it was found to be completely covered with stones, carefully laid just below the sod.

The specimens collected from this group of mounds show the high attainments of the mound-builders in the treatment of metals, and also a distinct order of potter's art, higher than has been known heretofore from the mounds. In contact with the mica and other material in the large mounds, small masses of iron were found, which at first sight might lead to the inference that the mound-builders were acquainted with the use of iron, or that the mound was erected after contact with the whites; but on careful examination this proved to be bog iron, which had formed upon the altar since the erection of the mound. Upon

two of these masses on either side will be seen the layers of mica between which the iron was found. Much of the mound over the altar was formed of ferruginous clay, and water in percolating through this clay would become impregnated with iron, which would be retained in the cavities formed in the material upon the altar over the hard-burnt clay. Bog iron might also be derived from the bituminous coal, clinkers and ashes from the fire upon the altar. This explanation accounts to me for the supposed rusted iron sword found in the Marietta mound in 1819 by Dr. Hildreth, which has been a puzzle to archæologists ever since. The silver-plated bosses, supposed by Dr. Hildreth to have been ornaments of the sword scabbard, are also fully accounted for by similar silver-plated objects from this mound.

Numerous mica ornaments were found in two of the mounds. They were cut from thin sheets of mica in various designs, conspicuously some like the head of some animal, one like a serpent, and one like a human head caricatured with a big nose and open mouth. The mica from which these ornaments were cut was probably North Carolina mica, which is known to have been mined before the settlement by the whites.

Besides one copper implement, copper occurred in great abundance in these mounds. Two of the mounds contained masses of native copper, and several contained many ornaments of various designs, cut from hammered copper. Many spool-shaped ornaments occurred with pendants, bracelets, rosettes, and scrolls. Several large sheets of copper, full of round holes cut at regular intervals, were found upon the altar of the large mound. A few copper ornaments were plated with a thin layer of hammered silver, neatly and closely applied to their surface by hammering. A bracelet and several of the spool-shaped ornaments were plated in this way. It is to these silver-plated spool-shaped ornaments that I refer the so called bosses on the sword scabbard described by Dr. Hildreth. The copper objects were all made from the native metal, which, while it may have been picked up in masses from the glacial drift, was more probably mined at Lake Superior, and the small quantity of native silver used in plating a few of the ornaments leads to the belief that the copper and silver were brought from Lake Superior. Besides ornaments of mica and copper, there was obtained, for the first time from a mound, an ornament made of buffalo horn.

There were found implements made of flint, and arrow points of quartz, of chalcedony, and of obsidian. Obsidian is not found to-day in this region, nor nearer to it than the volcanic regions of the Rocky Mountains, where the Indians still use it for making arrow-heads. Spearhead-shaped ornaments were made from a mica schist, by a peculiar method of working the stone, such as I have never before seen.

Several stone images were elaborately carved and grooved on the under side. These were more or less fractured by the great heat to which they had been subjected. In this small tray are what might be termed the gems of North American pottery. The little figures represent in clay the dress of the people, with the peculiar head-dress over the forehead, the large ear ornaments and the peculiar

form of sandal. Altogether, there is a resemblance in these little images to the character of Egyptian art which is very remarkable.

Besides the larger objects enumerated were a number of fossil shells, selected quartz pebbles, an immense number of shell and pearl beads of various sizes and shapes, and small sea shells which had been perforated. These were found on the altars mixed with ashes, charcoal, bits of mica, and fragments of pottery. All these objects had been subjected to a high heat, of which they still bear marks. From the altar in the great mound more than two bushels of such material was removed, and from an altar in another mound about one bushel.

There seems to be no other theory which will account for so much property having been given to the flames except that of sacrifice during important religious rites.—*Boston Transcript.*

ARCHÆOLOGICAL DISCOVERY IN CENTRAL AMERICA.

Of the fact of there being ruins of ancient cities, hitherto shrouded in mystery, scattered over that large tract of country which separates North from South America most persons are now aware. But their nature, age, or relation to the early history of the world has remained till quite recently a matter of which comparatively nothing has been known. It has, however, been for some time recognized that among the most interesting of these archæological remains are some in Yucatan—a peninsula dividing the Gulf of Mexico from that of Honduras, situated between 17° 30′ and 21° 51′ N. lat., and at no great distance from Cuba.

Determined to explore these ruins and learn the lessons they might teach, a scientific investigator, Dr. Augustus Le Plongeon, accompanied by his wife, set out on a mission of discovery to Yucatan in August, 1873, from which he recently returned. Ten years previous to this he had determined the task of writing an account of prehistoric America, and having dedicated himself to this work, had found, after having explored the ruins of antiquity found in Peru and Bolivia since 1862, that in Yucatan were situated the most valuable materials for such work; and a residence of nine years constantly engaged in explorations both of a super- and subterranean nature, has made him familiar with many of the Yucatan ruins. Both he and his wife being skillful practical amateur photographers, they have secured numerous negatives of the ruins, embracing many detailed portions. They have also obtained by means of a plastic material similar to what is used in French stereotyping, upward of two hundred casts from the more important sculptures and mural decorations, several of which are being reproduced in plaster, thus showing the work in fac simile.

Attention was concentrated upon the cities of Uxmal, Chichenitza, Ake and Mayapan. There are other cities as large as these, but they are in the possession of the hostile Indians. Still other cities exist which are fraught with interest in an exceptional degree, for they have been inhabited by a race of dwarfs, compared with whom the dwarfs of popular exhibitions are almost giants The di-

minutive stature of the inhabitants is shown by the buildings, the doorways of which, Dr. and Mrs. Le Plongeon assured us, are thirty-six inches high by eighteen inches in width. One of the largest temples in these dwarf cities is twelve feet long by nine feet wide, everything else about them being in the same ratio of dimensions. The names of some of these cities are Meka, Nicte, and Cankun. These are situated on the east coast of Yucatan, opposite the islands of Mugeres and Cozumel. They are at present very difficult of exploration, owing to the frequent visits made by parties of hostile Indians, who are well armed, and in skirmishes with whom no quarter is either expected or given.

In Uxmal there are several ruins in a state of excellent preservation. These prove in an incontestible manner that in early ages a high degree of civilization existed. The date of the erection of several of these edifices is believed to be not less than six thousand years ago, although Dr. Le Plongeon is of opinion that there is much that points to an antiquity of ten thousand years. It being of the greatest importance that the antiquity of these remains of a former civilization should be determined, we here present a few of the reasons given by which this is sought to be established.

In one temple, which is richly decorated both with marble and other stone, portions are profusely covered over with inscriptions and writings in the Maya language, in writing of an ancient nature hitherto unknown, but the key to which has been discovered by Dr. and Mrs. Le Plongeon, by dint of much perseverance. With this new alphabet they have been enabled to decipher many of these records of ages of the long ago. The age of these erections is discoverable, first from the Katuns found in the city of Ake, mentioned by the chroniclers, who tell us that at the time of the Spanish Conquest such Katuns were still being used. These consist of columns of stone, eight in a column. One is placed every twenty years. On the top of the seventh, and at each corner, is placed another stone, these corner stones being laid at intervals of four years, and on the completion of the twenty years represented by them a large stone is placed over all, thus completing the column, or Ahau-Katun, which thus marks a period of one hundred and sixty years. Now, in one building were found thirty-six of these columns, which represents at least six thousand years as the time that had elapsed from the erection of that temple to that at which the last stone was laid on these time columns; and the time that intervened between the completing of these records and the Conquest is not known in this case.

Another guide to the discovery of the antiquity of these erections is the worship of Deity in the form of the mastodon's head. Now, as this animal has been extinct for ten thousand years, it follows that either the builders of these temples or their fathers were familiar with it, for had they not known the mastodon they could not have made an image or picture of it, and all of the buildings throughout the peninsula are ornamented with the mastodon's head, and some of the sculptures represent human figures in the act of worshiping it.

The buildings in most cases are formed of a white limestone, the stones being all cut to nearly one size and very closely fitted together. The outsides are

square, but they are cut in a pyramidal form. The ceiling of the buildings form a triangular arch; the rooms are generally long and narrow, but very lofty, the walls and floors being cemented with concrete. At Uxmal is a building called Monjas, which consists of a hundred and twenty rooms, all arranged in pairs, each pair communicating with one another by a doorway, but with none of the others, except through the court yard. There are no interior sculptures, all being on the outside, and in these a certain local style or order has been observed, for while at Uxmal the ornaments are all found above the doorways and facades, at Chichenitza they reach down to the ground. One edifice, known as the Governor's House is 293 feet in length. They are mostly erected on artificial terraces composed of stones laid on the top of each other, one of these being similar in style to the "hanging gardens" of Babylon.

The great question of popular interest regarding these archæological remains is, What do they teach us? Apart from the history of the family affairs of the contemporary kings, which can now be read with comparative plainness by the explorers, it has been discovered that there is an almost absolute identity between the language, the manners and customs of these prehistoric Yucatanese and those of Chaldæa, Egypt, Hindostan, Persia, Burmah, and Siam, and that an early and cultivated civilization, imagined to be of a higher type than any other, existed in Yucatan. It has also been discovered and established beyond cavil that Freemasonry existed in these prehistoric times with the same Masonic symbols as are now in use, proofs of this being found in the photographs and casts; and that what is now known as mesmerism existed six thousand years ago in very much the same form as it does at present, as shown by the decorations on the frescoed walls. Among the customs common to the Yucatanese, are to be found some also common to the inhabitants of Hindostan, such as the manner of carrying children astride on the hip. The making of an impression of the hand in red pigment on the walls of certain sacred edifices was common in former times both to Yucatan, to Elephanta and other places in India, and even in caves in Australia and others of the South Sea Islands. There is scarcely a monument in Yucatan upon which is not to be found the impression of a red hand, this being the record of a vow made to the Gods. Fire worship, phallic and mastodon worship, together with gods having elephants' heads, flourished in Yucatan in these early periods.

The Maya language, still spoken in Yucatan, was also known in many parts of the East. The last words of Jesus of Nazareth, *Eloi, Eloi, lama sabachthani,* are said to be pure Maya words, and to mean, "Now, now, I sink, darkness comes over my face." From the narrative it would seem that none of those standing within hearing understood the language made use of, as they imagined he was calling upon Elias to aid him. Enough has here been said to indicate the great interest that attaches to Yucatan.—*Scientific American.*

ANCIENT MAN—A RE-CONSTRUCTION.

An effort has been made recently to represent "primitive man" upon such a basis as the fossil skull-cap, found in the Neanderthal, in 1857, is alleged by some archæologists to offer. The result of the effort is a bust of which the head and trunk at once suggest the gorilla, so much of brutal ferocity are impressed upon the facial lines, while attitude and cranial development approximate those of the fierce quadrumane. This ideal restoration has been on view at this office, together with a plaster cast of the fossil skull-cap, and so many inquiries have been made concerning our opinion of it, that the editor deems it suitable to occupy a little space in these columns in answering the oft-repeated question: "What do you think of it?"

First. We are not satisfied with the manner of the restoration, as we think that the fossil relic has not received full justice at the hand of the restorer. Taking the plaster cast as it has been furnished us, we are struck at once by its size; and by several peculiarities of structure which indicate an alliance to existing races whose crania are of the long or dolicocephalic type. If this skull-cap be a faithful relic of a "primitive man," then "primitive" men possessed heads and brains fully as large as modern man, as we find him represented in races of low class, as a whole, and as represented by individuals belonging to the civilized races.

The interior or brain space of the cast measures 6½ inches in length, 4½ inches in breadth at the ear openings, 2½ inches in vertical depth at the centre, 2¼ inches in depth in the frontal space, 1½ inches back from the nasal root, while the breadth in the same region is 3¾ inches.

Now taking from the collection of the Institute a skull of average capacity as found in white civilization, we measure its calvarium or skull-cap space interiorly, as we have just measured the cast of the Neanderthal, and find it to be 6½ inches long, 5 inches wide, 3 inches deep at the median region, 2½ inches in the frontal space, and 3⅞ in frontal breadth. This skull, it should be mentioned, is of the broad type, while the fossil belongs to the narrow. A critical comparison of the Neanderthal with a like part of an average negro skull from the Western or Southern Coast of Africa, or with a Patagonian or Australian skull, would not result unfavorably for the "primitive man" as regards brain volume. Mr. Huxley allows its capacity to be 75 cubic inches.

Second. Considerable stress is laid upon the projection of the supra-orbitar ridges by those who would find in this fossil some confirmation of their hypothesis of man's derivation from the lower animals. They point to them, and then to the great bony eminences over the eye-sockets in the gorilla head, and claim a direct relationship between the two organizations; apparently forgetting the great difference in general structure between them, that whereas the ridges of the gorilla are widely separated from the brain-pan, spread out laterally in a wide border of plate-like process, an inch or more, in the mature animal, beyond the brain

case, and rise considerably above its superior plane, while a strong ridge at the median line of the cranium unites anteriorly with two smaller ridges, one proceeding from the outer angle of one supra-orbitar prominence, and the other from the outer angle of the other. There are also other great bony processes coursing over the occipital portion of the animal's skull and around its base, intimations of the powerful muscular development of its jaws and neck. The ancient relic is smooth and entirely like the modern human skull in its general structure, none of those coronal, occipital, or lateral ridges being suggested by even a salience upon which a Huxleyite could rest an eye-glass. It must be remembered, too, that in producing this fossil, nature has replaced the original salient ridges with earthy matter, which by its accumulation to so great a thickness has probably much increased the apparent extent of the ridges; and consequently a fair estimate of them must take into consideration this tendency of the thickening process, as well as the relation which the inner plate of a skull bears to the outer at the supra-orbitar region.

The projection of these ridges is due, of course, to the breadth of the frontal sinuses, which are generally large in the males of savage races, the American Indian offering a good illustration of the fact. Mr. Huxley quotes Dr. Fuhlrott's language, that "a probe may be introduced to the depth of an inch" in the sinuses of the Neanderthal frontal bone. We have seen specimens of modern skulls, in which the separation of the inner and outer tables over the orbits extended fully an inch upward. Mr. Huxley alludes to the large circumference of this ancient skull, 23 inches, due, to be sure, to the great development of the supraciliary ridges, "though the perimeter of the brain case itself is not small." These ridges, he adds justly, "give the forehead a far more retreating appearance than its internal contour would bear out."

A writer in *Longman's Magazine*, in reply to a naturalist who has placed much stress on the supra-orbitar ridges or "bosses" of the Neanderthal fossil, as significant of its "bestial type," says: "What is posed as the 'Neanderthal skull,' is the roof of the brain case, or 'calvarium' of the anatomist, including the penthouse overhanging the eye-holes or 'orbits.' There is no other part of the fragment which can be supposed to be meant by the large 'bosses' of the above quotation. And in this assumption I have to state that the supra-orbital ridge in the calvarium in question is but little more prominent than in certain human skulls of both higher and lower races, and of both the existing and cave dwelling periods. It is a variable cranial character by no means indicative of race, but rather of sex."

It is in the structure and development of the brain that we should look for points of difference and relation. Open a gorilla skull, and immediately the great difference which separates it in form and volume of brain from man is evident. The gorilla, possessing the largest brain of the quadrumana—the highest in the scale of brutes—is thus seen to be after all but a brute. Quoting again from the writer above—"I have found that a vertical longitudinal section brings

to light in greatest number and of truest value the differential characters between the lowest *Homo* and the highest *Simia*."

To realize the character of the man who once thought and lived in the ancient Neanderthal skull, we must consider its interior capacity; and only by considering that, can we realize that he was a man very much like men we meet today in the walks of civilization. The artist may claim to use his skull-cap as a model, and build up a mass of plaster representing a brute-man with giant trunk and semi-hairy back and breast, with grinning savage jaws, and forehead low, in which the "bosses" are brought out into special prominence—and with a crown rising to a cone, unlike enough to the fossil—which is rounded in the coronal region—on which short grizzly hair exaggerates the brutish aspect, but cannot persuade us, who have had one glimpse into that fossil, that his work is faithful.—*Phrenological Journal.*

BOTANY.

CONDITIONS MOST FAVORABLE FOR VEGETABLE ACTIVITY.

PROFESSOR GOODALE.

The assimilative activity of plants is measured by the amount of carbonic acid consumed and oxygen given off. Respiratory activity is measured by the amount of oxygen consumed and carbonic acid given off. For most rapid assimilation the amount of carbonic acid must not exceed a definite amount for each sort of plant. Some people argue that if a teaspoonful of medicine is good, a whole bottleful at a dose would be better. But apply this to plants, and we soon find that if we increase the carbonic acid beyond a certain amount, the plant suffers from it. Geologists will then question how it was in the coal period. It has been concluded that there was really less carbonic acid in the atmosphere at that time than has been supposed. Moreover, we find that the equisetacea, and other descendants of the plants of that age, need more carbonic acid than do others. The amount generally found in the atmosphere seems best for plants at this time. For vegetable activity there is a maximum, minimum and optimum temperature. Let a plant grow where the conditions of moisture, heat, etc., can be *regulated*, and we find that, when the temperature rises above a certain limit, the plant dies, as does its individual cells; or let the temperature fall below a certain limit and the same thing occurs. These limits vary very much in different plants. Between these points lies the optimum temperature for each plant, which varies, of course, with the others. The optimum temperature for corn, e. g., is much higher than that of barley, and this fact has a very important bearing on the distribution of plants. From 110° to 120° is the maximum for ordinary greenhouse plants.

For others it does not exceed 70°. In a miscellaneous collection, some, of course, would suffer. Vegetable activity may be measured also by growth and movements. A description of apparatus devised by Dr. Wilson was given, and a picture of the same thrown upon the screen. It consisted essentially of a generator whence gases could be fed to a receptacle containing plants or germinating seeds, and an aspirator for withdrawing from this the products of growth through liquids which would attract and detain certain elements, as carbonic acid. Thus a stream of hydrogen could be fed to germinating seeds. Carbonic acid was found to be a product of the growth, and as no oxygen was given the plant, it must have come from the tearing asunder of the molecules composing the seeds. This was first tried in Professor Sach's laboratory. Apparatus to measure growth was then explained. A delicately weighted lever attached to the growing tip of a plant rested at the end against a cylinder of blackened paper turned by clock-work. As the plant elongated in growth the end of the lever would descend and indicate the rapidity of growth by the lines on the paper. Leaving out of view slight diurnal oscillations of growth not yet accounted for, we find that at the optimum temperature growth is accelerated, and that light slightly retards the same. Another and perhaps better way of testing vegetable activity was by measuring movements made by plants in growing. This was illustrated by views of various plants on the screen. On the hop vine the flexible end of the stem twists about a support, and thus raises itself into light and air with a slight expenditure of woody tissue, the whole revolution made is in from two to four hours under favorable conditions. The morning-glory has a long projecting arm which sweeps around and clings to support.

The jasmine solanum twists its leaf-stalks about other plants, and so climbs upward. The passion vine was shown to have tendrils, which were modified forms of branches, moving and sensitive. Virginia creeper has tendrils with a disk at the end, which fastens itself to support. The activity of these tendrils is increased in darkness, i. e., the plant is negatively heliotropic. Another form was shown in the leaf of the nepenthes, where a tendril was found between the blade of the leaf and the pitcher. In conclusion of this part of the subject the lecturer said that the observations made prove that the most favorable conditions for vegetable activity are, (1) supply of proper amount of the gases; (2) sufficient moisture; (3) best degree of heat; (4) requisite kind and amount of food.

This last point leads to a consideration of those plants which obtain part of their nitrogen from animal food. These may be divided into two classes: First, those which have fly-catching traps, as the *drosera*, where the leaf is covered with tentacles of various lengths tipped with a viscid liquid. These are not sensitive to straw or metal, but place on them a bit of beef or albuminous substance and they will close over it, and after a few days it will have disappeared. The *dionea* has at the end of its leaf-blade two valves bearing three sensitive bristles. The edge is also fringed with hairs. If an insect tonches this the valves close, the bristles on the edge interlock loosely; if the insect be small it escapes; if large, t is retained, a glairy fluid is exuded and the fly is digested as food is digested in

our stomachs. Touch these valves with the poles of an electric battery and they will close. Attach a galvanometer, cause them to close, and an electrical disturbance will be noticed. This was long held to be comparable to the electrical disturbance noted when a muscle contracts, but it has been proved that the same thing occurs if any leaf or stem be bent in the same way, and is owing to the rapid passage of fluids from one cell to another. The pitcher plants and other insect-catching plants, as the *utricularia* and *pinguicula*, were described, explained by diagrams and shown on the screen.

Whether these insects, etc., were really appropriated as *food* was next considered. Francis Darwin proved that the *drosera* fed with nitrogenous food surpassed others not so fed. In the case of the pitcher the experiment had been tried of feeding flies with saccharine matter in which was a trace of lithium. The flies were then given to the plants, and by means of the spectroscope the lithium was subsequently found to have become a part of their tissues.

POWER OF VITAL FORCE IN GERMINATING SEEDS.

During the years 1873 and 1874, a variety of experiments were made at the Massachusetts Agricultural College, with a view to determine the amount of force exerted in the growth of plants. These experiments are very fully described in two lectures by Pres. Clark, which are given in the Reports upon the Agriculture of Massachusetts for those years. Doubtless the publication of these lectures gave an impulse to the practicing of experiments in other places. Recently, the botanical faculty at Wellesley College have been experimenting upon the germination of seeds.

We are indebted to our South Natick correspondent, Mr. A. P. Cheney, for the following condensed report of two of these experiments.

Three pints of marrowfat peas were placed in a strong iron vessel, into which a cover was so fitted that while it would readily pass down inside, it would not allow any peas to pass up by it. Scales, capable of weighing something over half a ton, being prepared for the purpose, the vessel of peas was placed upon the platform, and warm water added. This was done at 7.45 A. M.

At 8.00 A.	the pressure from the swelling of the peas amounted to	. . . . .	75 lbs.
9.00 A. M.	it had risen to	. . . . .	300
9.50	"	. . . . .	432
11.00	"	. . . . .	585
12.00 M.	"	. . . . .	687
1.05 P. M.	"	. . . . .	778
2.00	"	. . . . .	855
3.10	"	. . . . .	943
4.00	"	. . . . .	980
4.45	"	. . . . .	1025

6.00	"	 1080
7.40	"	 1141
9.00	"	 1175
10.00	"	 1193
10.45	"	 1195
6.45 A. M.	next day it had risen to	 1227
8.00 "	it had risen to	 1300

At this point the platform of the scales broke down, and so put an end to that trial. It will be seen that during the first quarter hour the pressure increased at the rate of five pounds per minute. From eight to nine o'clock, the record was made every five minutes, and it was found that the increase varied from five pounds down to one and four-tenths pounds per minute. Later in the day there were times when the movement nearly ceased, as during the forty-five minutes after ten o'clock, P. M., only two pounds were gained. The cause of these variations was chiefly, if not wholly, the changes of temperature.

The next experiment in this list was made with three pints of beans. This trial was commenced Monday, February 5th. When observed

At 8.00 A. M.	the pressure was	. . . . .	55 lbs.
9.00	"	. . . . .	375
10.00	"	. . . . .	620
11.00	"	. . . . .	875
12.00	"	. . . . .	1165
1.00 P. M.	"	. . . . .	1275
2.10	"	. . . . .	1351
3.00	"	. . . . .	1410
4.00	"	. . . . .	1475
5.00	"	. . . . .	1515
10.00	"	. . . . .	1670

Tuesday:

At 7.45 A. M.	the pressure was	. . . . .	1845 lbs.
8.00	"	. . . . .	1860
9.05	"	. . . . .	1925
10.00	"	. . . . .	1960
11.15	"	. . . . .	2025

The rate of increase of pressure varied much more in this trial than in that with peas. During five minutes of the hour between eight and nine o'clock, A. M., on Monday, the increase was *eight pounds per minute*, while a period of twenty minutes, between twelve and one, P. M., the same day, showed only nine pounds increase, or less than half a pound per minute.

The relative rate of increase of the pressure of the swelling beans was much more rapid than that of the peas, for while the peas, with fully as close attention, attained to a pressure of but six hundred and eighty-seven pounds at noon of

the first day, the beans showed eleven hundred and sixty-five pounds in the same length of time.

When the beans were removed from the vessel in which the trial was made, it was found that many had sprouted, or rather, that the sprouts had grown to be half an inch or more in length.

We could wish that time and space permitted a further statement of the facts in these cases, but we must stop. These experiments are conducted under the immediate supervision of Miss Susan M. Hallowell, Professor of botany at Wellesley College.—*Natick Citizen.*

ASTRONOMY.

TRUE TIME TAKEN AT KANSAS CITY BY REGULAR STELLAR OBSERVATIONS.

W. W. ALEXANDER.

In order to obtain time we must have a starting point, something must be noted, and its return or repetition again noted. To have our time perfectly equable or uniform in its increase, this event must be certain and regular. Then we can avail ourselves of some mechanical means to subdivide this interval into equal parts; this is what our watches and clocks are intended to do, but they must have something to start from and also to regulate their rate of speed; if not one will gain, another lose, or if two should agree both may be wrong, for a chronometer, no matter how well made, will after a long lapse of time show a variation in its rate of motion. For the benefit of the public I will here explain the method adopted by astronomers: It is to watch the daily rotation of the earth which presents us with a beautiful and accurate time signal, in fact it is the only regular and constant motion known; it has been watched by astronomers for centuries past and not a fraction of variation found (this regularity is of infinite value to them in determining the eccentricity of other celestial bodies), so they have adopted this rotation as the base to measure the flow of time. In order to use it some stationary point must be found outside and separate from the earth. The fixed stars filled this want, but what one to use was the next question, there being over 300,000 visible. It was finally agreed by astronomers to use the first point of Aries, or the intersection of the equator and the ecliptic at the vernal equinox for the commencement of the sidereal day. From the time a meridian leaves this point until it returns is twenty-four hours, or one day sidereal time; the hours are divided into minutes and seconds. Watching our meridian move eastward across the heavens all the stars are found to be crossed by it; the interval from the time this day began until the star is on the meridian is called

the "right ascension" or sidereal time of its meridian passage. The right ascension of our 300 stars known as the "standard time stars" have been determined with all attainable precision. The greatest variation, if any, cannot exceed the tenth part of a second in time; they are distributed all the way round the circle of the heavens at intervals of about five minutes for convenience of observers who require accurate time at all hours of the night, the brightest can be observed even in daylight, so at all times they are available (if the sky be clear) without much delay. A catalogue of them is published every year by the United States naval observatory, Washington, for the use of American astronomers and navigators.

All that is necessary in order to set and regulate a time-piece is a transit instrument adjusted, collimated, or placed at a right angle with its axis, and set to swing north and south, the axis being level. The one I have in use here is a two and three-quarter inch aperture achromatic of forty-eight inches focus, magnifying seventy-five diameters; have it in fine adjustment and set in the meridian, stars observed south and north of the zenith agree in time to a fraction of a second. This proves it to be in the meridian and the time correct. The passage of the star is observed at five equidistant vertical wires, two on each side of the meridian wire on line. The instant at which the star is bisected by each wire is noted in a new chronograph, a very ingenious machine that works on the following principle: A round disk of paper placed upon a horizontal block of wood four inches in diameter, is made by accurately running clock work to turn around once in a minute of sidereal time, or nearly so (a slight variation may be corrected.) A needle point is arranged a short distance above the moving disc, which simultaneously with the pressing of the spring, makes a hole in the paper and re-adjusts itself in position in less than the hundredth part of a second. At each round of the disc, the needle point moves in toward the center of the paper the sixteenth part of an inch, which prevents confusion in distinguishing the punches. To illustrate its use take the transit of Procyon, April 10, 1883. From the catalogue of stars I found that at 7 h., 33m. 12.17s Procyon would be on the meridian. So at about three minutes before that time I arranged and placed the disc of paper in position and started the chronograph running, went to the clock I wished to time and watched it until it indicated 7h., 31m., 0s. exactly, then touched the spring which marks the paper, carried it to the transit, and, simultaneously with the star's passing the first vertical wire, I again pressed the spring, and at the second, third, and so on until the five were passed, then removed the disc of paper and placed it on the reading dial, which showed by the relative position of the marks, the interval from the time of the mark made at the clock to those made at the transit. In the above observation the time noted was as follows:

	Min.	Sec.
First wire	1	46.2
Second wire	2	00.3
Meridian wire	2	14.4
Fourth wire	2	28.6

Fifth wire	2	42.6
	11	12.1
Mean of the five wires	2	14.2

The mean of all the wires correct the error in observation at the central or meridian wire. In the above 2′ 14.14″ was the observed time at the central wire, 2′ 14.42″ as the mean of all the time noted at the different wires. This was the time that had passed 7h, 31′ 00″ by the clock, add the two given 7h, 33′, 14.42″, the time by the clock at which the star was on the meridian. True time of meridian passage from catalogue, 7h, 33′, 12.17″, clock fast 2¼″, or the difference between the observed and the true time. Observations made on seven other stars all agree within 0.3″ This proves the time without doubt to be within that limit of error.

Time is something everybody should know, there is but one true mean and sidereal time to each meridian. Mean solar time, or as it is commonly called, mean time, is the one in ordinary use, the one clocks and watches are intended to keep. It is perfectly equal in its increase, and is measured by the motion of a ficticious sun called a mean sun, that is supposed to move in the celestial equator with a uniform velocity. This mean sun is supposed to keep on the average, as near the real sun as is consistent with perfect uniformity of motion, it is sometimes in advance of it, and sometimes behind it, the greatest deviation being about six minutes. This error in the time taken from the sun is called the "equation of time," and was found from the accuracy of sidereal time, which can be converted into mean time at any hour of the day. Time varies as we go east or west. In this latitude the difference is a trifle less than four seconds to the mile. So the time at the eastern limits of our city will be ten seconds faster than at the bank of the Kaw river.

The transit is placed in the rear of No. 1416 Holmes street, in West longitude 1 hour 10 minutes 08.0 seconds from Washington. The time there obtained is reduced to the meridian of Main street, at the intersection of Seventh, by subtracting 1.7 seconds. A clock indicating this time (i. e. mean solar, commonly called "city time") can be seen at No. 16 East Seventh street, where corrections will be kept as near as possible by conveying the time with a pocket chronometer. The time thus conveyed will always be reliable within one or two seconds. Persons wishing it more correct are invited to call (on any clear evening) and see observations made with transit. Time observations at Kansas City will be a regular and permanent thing, and are intended mainly for the benefit of the public.

KANSAS CITY, April 14, 1883.

THE SUN AND PLANETS FOR MAY, 1883.

W. DAWSON, SPICELAND, INDIANA.

The Sun's mean Right Ascension (mean distance from the Vernal Equinox) on May 1st is 2h. 37m., or 39°; and this increases about four minutes every day, so that on May 31st the mean Right Ascension of the Sun will be 4h. 35m, or 69°, an increase of two hours during the month. Now this Right Ascension of the Sun subtracted from the Right Ascension of any star will give the time that Star crosses the Meridian, or south. Then Regulus (the bright Star in Leo) whose Right Ascension is 10h. 2m. will south at 7:25 P. M. on the 1st, and about four minutes earlier each day afterwards. Beta of Leo, or Dembola, south's 1h. 41m. later than Regulus. An excellent way of obtaining true mean time is by observing with a transit instrument or other meridian mark the moment when a star souths.

A great eclipse of the Sun will occur at the time of New Moon, May 6th. An interesting account of this eclipse is given in the REVIEW for April. This noted phenomenon occurs about 3 o'clock in the afternoon, Kansas City time, and might be visible here if the Moon were only about its own diameter further north. An eclipse of this series will occur every eighteen years and about eleven days; and a little farther north every time. So it will likely be visible here in the distant future—probably near 200 years. The Moon comes to First Quarter May 13, about 4:30 P. M. That night—if the sky is clear, will be a good time to view the Moon through a telescope. The mountains and shadows, valleys, &c., show better near the quarter than at other phases. Jupiter graces the western sky as being the brightest star in that region. On the 16th, about 8 P. M. his four Moons will afford an interesting sight through a small telescope —being two on each side of the planet, and near together, like a double star above and another just below the planet. Saturn is near the western horizon—a few degrees southwest of the Seven Stars. It will soon be lost in the Sun's rays. Venus is the bright morning star in the southeast. In the telescope it presents a delicate half-moon shape. It and Mars will be near together about the 9th and 10th. But Mars is much dimmer than Venus, and will be north a little farther than the Moon's diameter.

THE GREAT RUSSIAN TELESCOPE.

We have seen the wonders of the starlit sky through the largest and best refracting telescope in the world; but the wonderful instrument is not destined to remain in this country. The most important part of it, the object glass, with the cell that holds it in place, will soon be on its way to the Russian Observatory of Pulkowa, located on the Pulkowa Hills, nine miles south of St. Petersburg, and commanding a fine view of the Capital. The Observatory was built and richly

endowed by the Czar Nicholas in 1839, and has won high renown on astronomical annals for the work it has already accomplished under its first director, the eminent astronomer Wilhelm Struve, as well as under his son, Otto Struve, who became director in 1864, upon the death of his distinguished father, and still holds the honorable position.

The Russian Government was not satisfied with the capacity and size of the present working force of the observatory, and determined to have a new refracting telescope constructed which, in mechanism and optic power, should surpass any telescope in existence. The director (Struve) was commissioned to carry out the plan. The most perfect workmanship attainable was to be put in requisition, and Struve chose from all the world, for the execution of the difficult and delicate task, the Messrs. Alvan Clark & Sons, the famous telescope-makers of Cambridgeport, Mass.

Struve came to this country and intrusted to their skillful hands the making of the object-glass, with a diameter of thirty inches, and its cell. The mounting of the great telescope is being made in Hamburg, Germany, by Messrs. Repsold & Sons. The Pulkowa object-glass is four inches larger than that of the Washington telescope, finished in 1873, and seven inches larger than that of the similar instrument recently completed for the Princeton Observatory, both telescopes being the work of the same makers. The arrangements with Messrs. Clark were made in the summer of 1881, and the great objective was completed in October, 1882.

A temporary equatorial stand was erected in the yard of the workshop, in order to test the quality, power and perfection of the glass. It consists of a pier of solid masonry, to which a tube of sheet-iron, made in three sections, is firmly fixed, with the necessary mounting to secure its movement in the required direction. The object-glass, the eye-pieces and other appurtenances being then placed in position, the great refractor was ready to show its working power and to reveal any slight imperfections in the polish or finish that required attention. The precious glass bore the testing process with triumphant success, and is pronounced by the makers to be the best that has left their hands.

But the supremacy of the Russian telescope as the largest of its kind in the world will be of short duration. The same trial mounting will be used by the Messrs. Clark for testing the thirty-six inch object-glass which they have engaged to make for the Lick Observatory of California.

The pier of the temporary structure is twenty-seven feet in height; the tube is forty-five feet in length, with an aperture of forty inches in diameter. Figures, however, give a faint idea of this giant structure. It must be seen looming up under the sky before its huge dimensions can be realized. A view of the heavens through its great eye must be taken before its wondrous light-gathering power can be imagined.

The evening of our observation is intensely cold, but the sky is undimmed by the shadow of a cloud, the atmosphere is free from a breath of moisture. The heavens present a scene of exceeding beauty as the party of observers take their

places under the stars. The last lingering rays of twilight faintly suffuse the West, the new Moon, only a day old, holding the old Moon in her arms, is nearing the horizon, and the zodiacal light spreads its cone of pale gold high up among the eternal stars. Under the dark dome arching above us the brightest stars and clusters of stellar space look down with friendly eyes, and seem to hang low, as if they would hold communion with mortals. Among them thread the planets Jupiter and Saturn, whose mysterious portals we, audacious invaders, are seeking to enter this night with necromantic art. Rising from a surface of unbroken snow, and looming up with shadowy indistinctness, the huge telescope seems to pierce the skies, while the observers at its base dwindle to pigmies.

After a short time the instrument is ready for action; its open eye is turned upon the planet Saturn. The serene star, upon which a moment before we had turned our unaided eye, is suddenly transformed into a creation of surpassing beauty. A superb golden sphere, as large as the full Moon, lies before us. Saturn is softly cradled in the protecting embrace of his engirdling rings, and seven of his eight moons are visible as bright points on the dark background of the sky. Titan, the largest moon, has a perceptible disk. Every detail of the magnificent and complex Saturnian system is complete. The outer ring, with its faint line of division; the division between the outer and inner rings; the inner or second ring; the third or crepe ring, closely joined to the second, the break on the rings formed by the shadow or the planet; and the soft markings on his disk. Nothing is wanted in the minutest details, and there is but one imperfection in the picture. The definition is not good; the outlines are not clearly defined. The view does not differ greatly in dimensions from that presented by a smaller telescope, but planet and rings are flooded with light of delicious brilliancy and softness. Here lies the advantage of a great telescope. It brings to the eye all the light that enters it, so that, within certain limits, the larger the telescope the larger the amount of light it collects, the more easily visible will faint objects become, and the greater the number of objects before unseen that will be revealed.

Terrestrial colors are muddy in comparison with the celestial hues of liquid gold of the disk and rings, and the creamy tints of the belts that cross the disk with the lightness and grace of scudding cloud bands. The sphere seems almost to stand upright within the encircling rings, only a small portion of the planet being seen beneath them. We have fallen upon favorable conditions for a view of Saturn, for his rings are opening to their widest extent, his northern declination is increasing, and he is approaching perihelion.

Jupiter is the next object to test the space annihilating power of the instrument. The Prince of Planets is superb, larger than the full Moon, though but little larger than we have seen him many times in a telescope of eight inches aperture. He is, however, much brighter, and though by no means as magnificent as Saturn, we have the pleasure of feeling that we see him on a much larger scale. He seems so near that we are impelled to put our hands behind the glass and touch him. His broad belts are delicious in coloring, now suffused with pale

rose, or mottled with soft gray, while shades of purple, brown, and delicate green are interspersed. Never before did we behold the variety of tone and tint, the flood of light we see this night. Never did our giant brother seem so near, so grand in proportions, so symmetrical in equipoise. His four satellites are brightly beaming on his left, and bear testimony to the power of the telescope by presenting disks instead of points. The famous red spot is wanting in the view. We mourn its absence, for, since 1878, its well known features have become as familiar and firmly fixed as if they were a permanent feature on the planet's disk.

What shall we see next? is the question now discussed, for the extreme cold has congealed the oil, and the monster refuses to move. His eye is turned to the meridian, and no effort will make him swerve one inch to the right or left. In this emergency, a member of the party volunteered to mount to the top of the pier and lubricate with fresh oil the joints of the giant. The plan is successful, and, with many a shriek and groan, the lower end of the tube rises and the upper end falls, until the Cyclopean eye points to the great Nebula in Orion.

The little wisp of cloud haze visible to the naked eye is transformed into one of the most glorious visions that ever breaks upon the entranced eye of the observer. The most wonderful nebula the northern sky reveals lies before us, filling the whole field of view and suffused by a light that never was seen on sea or shore. Now we appreciate the power of the great telescope, the triumph of the optician's art. For definition is of little consequence in observing the shadowy nebula. Light is needed, and light comes.

The delicacy of the celestial glow that pervades the scene is beautiful beyond comparison. The central point of interest is the famous trapezium, consisting of four bright stars and two smaller ones. Around this sextuple group radiate what seem to be the head and branching horns of some huge animal, the trapezium occupying the open mouth, and surrounding a space of sky within which reigns the blackness of darkness Spiral curves of nebulous haze fill in the field of view, the radiating mass being of a delicate green tint, while dotted over the shadowy haze are many brilliant stars, throwing an element of life into the formless void and helping to light up this scene of loveliness and grandeur which no pencil may paint nor pen describe. We feel, while with reverent eyes we gaze upon the picture, that we are looking within the eternal gates, and enjoying a glimpse of the glory to be revealed, that "eye hath not seen nor ear heard"

It is said that no one can look upon the Apollo without standing erect and feeling a sense of the divinity inherent in human nature. But what is this masterpiece of Greek art, chiseled by human hands from a block of marble in comparison with this creation from Nature's fashioning hand brought near to mortal eyes by telescopic art! Where but in the heavens shall we find such an exhibition of majesty, vastness and celestial grace as is symbolized in the great Nebula of Orion, beaming with suns, peopled with ghostly shadows, and glowing with light that is hundreds of years old when it reaches us! Our earth and her brother planets will have cooled down to dead worlds, the Sun's fires will be quenched

in utter darkness, when the star dust on which we are now looking will quicken with the pulse of physical life, throw off its concentric rings, and concentrate into beaming suns and systems to take the place of those whose race is run, whose mission is fulfilled.—*Scientific American.*

BOOK NOTICES.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, Part III, October to December, 1882; octavo, pp. 160; Philadelphia, 1883.

This Part comprises the thirty-fourth volume of the Proceedings of the Philadelphia Academy, which has had a long and useful career. Most of the leading scientific men of this and former generations of Philadelphians have been members of it, and it has put forth some notable volumes based upon original investigations and discoveries.

The present volume contains contributions by such distinguished writers and students as Professors E. D. Cope, Heilprin, Leidy, Meehan, Carvill, Rev. H. C. McCook, Dr. Harrison Allen, etc.; also full reports by the various officers, showing the institution to be in a very flourishing condition.

The officers for 1883 are Prof. Joseph Leidy, M. D., President; Thomas Meehan and Rev. H. C McCook, Vice Presidents; E. J. Nolan, M. D., Recording Secretary and Librarian; George H. Horn, M. D., Corresponding Secretary, and William C. Henzey, Treasurer.

HISTORY OF THE NEGRO RACE IN AMERICA: by Geo. W. Williams; Vol. I, Octavo, pp. 481. G. P. Putnam's Sons, New York, 1883. For sale by M. H. Dickinson.

Having referred quite fully to the general scope of this work in the April number of the REVIEW, it is unnecessary to recur to it or to repeat the favorable comments then made upon the ability and skill manifested by the author in handling his subject. The present volume is devoted to an account of the negro race in America between the years 1619 and 1800. Commencing with the unity of mankind and considering the subject in the light of philology, ethnology and Egyptology, the author proceeds to discuss primitive negro civilization, the negro kingdoms of Africa, the Ashantee Empire, African idiosyncrasies, languages, literature and religion, Sierra Leone, the Republic of Liberia, etc.

In Part II he considers the history of slavery in the Colonies of Virginia, New York, Massachusetts, Maryland, Delaware, Connecticut, Rhode Island, New Jersey, South Carolina, New Hampshire, Pennsylvania and Georgia, giving the laws regulating slavery in each and many other facts which have been collected with great pains, and carefully condensed.

Part III is devoted to an account of the services of the negroes during the Revolution, including their military employment; their legal status; the statutory prohibition against educating them; notices of Bannaker, the negro astronomer; Fuller, the mathematician, and Derham, the physician; slavery during the Revolution, as a political and legal problem.

Mr. Williams, though a very dark-skinned and pronounced negro, is a lawyer and has been a member of the Ohio Legislature. He is a vigorous writer and a hard student. In the preparation of these volumes he has consulted over 12,000 volumes, besides thousands of pamphlets, and has succeeded in producing a work which will be an authority on the subject treated until a better one is produced, which is likely to be a long time.

PROCEEDINGS OF THE DAVENPORT ACADEMY OF NATURAL SCIENCES; Vol. III, Part III, 1879–81, octavo, pp. 314; 1883.

The whole of this Volume is devoted to an account of the life and labors of Joseph Duncan Putnam, late President and life-long active member of the Davenport Academy of Natural Sciences.

Though dying at the early age of twenty-seven, Mr. Putnam had acquired an extended reputation as a scientist, especially in the field of entomology. Having been compelled on account of his health to travel largely in different portions of the United States, east and west, took occasion to pursue his studies at all times and gathered more than 25,000 specimens of insects, including many new species, several of which have been named in his honor and in recognition of his attainments in this branch of science. This volume of the Proceedings of the Academy is a grateful monument to his memory by worthy associates.

THE FORESTS OF ENGLAND: by John Croumbie Brown, LL. D.; 12mo., pp. 271. Oliver & Boyd, Tweedale Court, Edinburgh, 1883.

This volume is stated by the author, who is Professor of Botany in the South African College, Capetown, and has held several prominent positions of kindred character in England, to be a compilation of what has been published previously as contributions to the literature of Britain on subjects pertaining to Forest Science. It is to be followed by another—now in press—a translation of the famous Forest Ordinance of France of 1669, with notices of the previous treatment of forests of that country.

This work is devoted chiefly to accounts of the laws and usages concerning forests, chases, parks and warrens, with particular descriptions of ancient forests, modern woods and forests. Among these are selected for illustration Sherwood Forest, Epping Forest, Dean Forest and New Forest, with accounts of Robin Hood and his tomb, the Parliamentary Oak, the buried remains of mammoths, lions, bears, etc., in various forests.

Many historical notices are also given of Forests of which nothing now re-

mains but the names; remains of ancient forests buried in the ground and submerged in the sea, descriptions and speculations upon petrified forests, closing with Forest Legislation, ancient and modern, and forestal literature previous to the 16th century.

It is an exceedingly instructive work to the antiquarian as well as to those interested in forests at the present day.

PROCEEDINGS OF THE BOSTON SOCIETY OF NATURAL HISTORY; Vol. XXI, Part IV, January to April, 1882; octavo, pp. 123; Boston, 1883.

The contents of this volume are as follows:

Mr. William M. Davis, On the Classification of Lake Basins (conclusion); General Meeting, February 1, 1882. Prof. H. W. Haynes, Indications of an Early Race of Men in New England. Mr. S. H. Scudder, A New and Unusually Perfect Carboniferous Cockroach from Mazon Creek, Ill. Dr. W. J. Hoffman, List of Birds Observed at Fort Berthold, D. T., in September, 1881. Mr. F. W. Putnam, Remarks on Stone-Implements from Marshfield, Mass., and Sag Harbor, N. Y. Mr. S. Garman, On Mounting Museum Specimens; and on the Nesting of the Rock-Wren. Dr. M. E. Wadsworth, Zircon-syenite from Marblehead, Mass.; General Meeting, February 16, 1882; Section of Entomology, February 22, 1882. Mr. S. H. Scudder, Occurrences of Southern Butterflies in Maine; Notes on Tertiary Neuroptera from Florrisant and Green River; General Meetings, March 1 and 15, 1882. Mr. Wm. Trelease, Structures which Favor Cross-Fertilization in Several Plants. Mr. S. S. Kingsley, On the Development of Molgula Manhattensis. Gift of Mr. Fred. Habirshaw's Collection of Diatomaceae; General Meeting, April 5, 1882. Mr. N. F. Merrill, Concerning the Lithological Collection of the Fortieth Parallel Survey; General Meeting, April 19, 1882; Section of Entomology, April 26, 1882. Index. Errata.

This is one of the oldest Societies of the kind in the Country and its work is of the highest order.

OUR CHOIR: by C. G. Bush; folio, pp. 20, copiously illustrated. G. P. Putnam's Sons, 1883. For sale by M. H. Dickinson; $1.50.

"I write of choirs, of many choirs,
Of choirs that gather weekly,
Of choirs, from those that sing in style,
To those that charm most meekly.

Of choirs in churches rich and poor,
Of choirs of ancient date
Of choirs that sing in tune, and out,
Of choirs both gay and sedate."

This brochure, to which the above is the introduction, is devoted to depict-

ing, by ironical words and amusing illustrations, the comical side of church singing, and in our judgment it teaches some admirable lessons by holding an exaggerated mirror up to nature. If each church choir in the country were to procure a copy and keep it at hand for convenient reference no harm would result either to singers or congregations.

OTHER PUBLICATIONS RECEIVED.

Circular of Information from Bureau of Education, No. 4, 1882, Washington, D. C. *Christian Philosophy Quarterly*, New York; published by Anson D. Randolph. *The Electrician*, May, 1883, New York. Parish Institutions of Maryland, April, 1880; Published by John Hopkins University. John Hopkin's University Circulars, February, 1883, Baltimore; price 10c. *Knowledge*, March, 1883, London. Experiments Chiefly with Kerosene on the Insect affecting the Orange Tree and the Cotton-Plant, 1883, Washington. Reports on Rocky Locust and the Chinch-Bug, 1883, Washington. Report on Michigan Forest Fires of 1881–82, Washington. Local Government in Michigan and the Northwest, No. 3, Baltimore, March, 1883. Coal, from *Cumberland Review*, April, 1883. Proposed Ordinance and Rules and Regulations for the Regulating of Plumbing, etc., P. Blakiston, Son & Co., Philadelphia; price 10c. Darwin and Humboldt, J. Fitzgerald, New York; price 15c. Reports of Comptroller, City Engineer, December 31, Kansas City, Mo., Ramsey, Millett & Hudson. Cornell University Register, 1882–83, Ithaca, N. Y. Bulletin of American Geographical Society, 1882, New York, No. 3. Local Government in Illinois, January, 1883, Baltimore, John Hopkins University. Report from San Miguel County, 1882, Las Vegas, N. M. Proceedings of the Academy of Science, Philadelphia, 1883.

METEOROLOGY.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

In the record from March 20th to April 20th here given, it will be noticed that the usual high winds of March have been delayed this year till April. At the close of this report cherry, plum and apple trees are in blossom and the forest trees begin to look green. Altogether the season continues very backward. The rain fall is rather light but as yet nothing suffers especially from drought.

The barometric range has been specially low in April, and these low pressures have been accompanied by wind-storms in which the velocity has several times reached sixty miles per hour. The wind-travel on April 14th was nearly 1,000 miles.

The maximum thermometer recorded 93° on the 13th.

Thunder-storms occurred April 4th and 12th.

Rain has fallen on nine days.

The prevailing winds of the first decade were north and west, those of the last two decades were south.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Mar. 20th to 28th.	April 1st to 10th.	April 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	24.4	40.1	50.3	38.3
Max	48.9	69.2	75.4	64.5
Min. and Max	37.2	54.15	62.8	51.4
Range	24.4	28.1	25.1	25.9
TRI-DAILY OBSERVATIONS.				
7 a. m.	28.8	42.9	51.8	41.2
2 p. m.	47.0	64.2	74.6	61.9
9 p. m.	36.9	50.4	59 6	48.9
Mean	37.4	51.41	61.39	50.4
RELATIVE HUMIDITY.				
7 a. m.	. .	. .	. .	. .
2 p. m.	.	. .	.	. .
9 p. m.	. .	. .	. .	. .
Mean	. .	. .	. .	. .
PRESSURE AS OBSERVED.				
7 a. m.	29.27	28.92	28.83	29.01
2 p. m.	29.26	28.95	28.80	29.00
9 p. m.	29.24	28.94	28.80	28.99
Mean	29.26	28 94	28.81	29.00
MILES PER HOUR OF WIND.				
7 a. m.	9.2	11.7	18.0	13.0
2 p. m.	16.1	28.8	30.6	25.2
9 p. m.	11.0	13.7	18.8	14.5
Total miles	2560	4490	4568	11618
CLOUDING BY TENTHS.				
7 a. m.	5.9	5.0	6.4	5.8
2 p. m.	4.0	4.8	3.6	4.1
9 p. m.	3.5	2.3	4.8	3.5
RAIN.				
Inches	1.40	0.01	.76	2.17

SCIENTIFIC MISCELLANY.

OLD MAPS.

PROF. G. C. BROADHEAD.

The study of the olden maps of our country is instructive. From them we see at a glance the wonderful progress of settlement and the important changes that have taken place in boundaries and political divisions. They are an epitome of history.

Jefferson's Notes on Virginia, 1801, contains a county map of the State, showing that the portion of the State east of the Blue Ridge does not materially differ from its present divisions, but west of the Kanahawa (the spelling of Mr. Jefferson) River, the only counties then organized were Wythe, Washington, and Russell; all in the extreme southwest. While north of the K. River and west of the Alleghany Mountains are only six counties, viz.: Kanahawa, Greenbrier, Randolph, Monongahela, Ohio, and Harrison. Northwestward across the Ohio River we find Northwest Territory where now is the populous State of Ohio.

In Geology of North America, by Wm. Maclure, Phila., 1817, there is a map of the United States, colored according to the then accepted geological nomenclature as Primitive, Transition, Secondary, Alluvium and Old Red Sandstone. This was the first Geological map published of the United States. Besides the olden states we find upon it Alabama Territory, Illinois Territory, and Northwest Territory, the latter having been removed farther west than on Mr. Jefferson's map; extending north from Illinois to British America, and lying between Lake Michigan and the Mississippi River. The State of Louisiana had its present bounds, and Missouri Territory extended from Louisiana northwardly to British America, and from the Mississippi River indefinitely west. Kansas River is spelled Kans., and Arkansas is spelled Arkansaw, as pronounced. A Choctaw village we find located on the south side of the Arkansas River, not far from the present location of Little Rock. A Delaware village we find on White River, just below the junction of Black River (in Arkansas). An Osage village on the south side of the Missouri River. A Kans (Kansas) village near where Wyandotte, Kansas, now stands. A Sac village at the mouth of Des Moines, and another just below the mouth of Rock River. On this map we also find Chicago placed directly at the north boundary of Indiana, and the northwest corner of that State is considerably to the westward.

In the Gazetter of Illinois and Missouri, by L. C. Beck, Albany, N. Y., 1823, we find seventeen counties south of the Missouri River and ten north, and three of the latter, Ralls, Chariton and Ray occupy the northern portion of the

State from the Mississippi River to the western State boundary. Lillard county extended from the Missouri River to Grand River, and Saline bounded it on the east. Saline and Cooper extended from the Missouri to the Osage. Wayne county included a fourth part of south Missouri, extending from Washington to the west State line.

On this map Pike County included all of Illinois west of the Illinois River, and on the north reached across to Indiana. There were twenty-six counties in Illinois, and Ft. Dearborn was on Lake Michigan where now is the city of Chicago.

In Schoolcraft's Travels, through certain portions of the Mississippi Valley, 1821, we find a small map of the Ohio Valley with Illinois, Michigan and Eastern Missouri. On this map we find laid down on the north side of the Ohio, from opposite the mouth of White River (of the Wabash) to opposite the mouth of Tennessee River, the Oshawana (Shawnee) mountains. From Chicago to St. Louis and near the Illinois River, we find Mt. Joliet, Rock Fort, Ft. Clark, and Mauvais Terre. In this volume there is also a small geological sketch map of the Lead District of Eastern Missouri, extending from the Missouri River to beyond Fredericktown. This map is printed with south at top, and north at bottom.

On Mitchell's Map of Missouri, 1835, we find that there were then thirty-two counties in Missouri, and Green county joined Gasconade and Crawford on the east, with Pulaski on the south, while west of these the State seemed yet not to be divided into counties. Jackson and Lafayette extended to Grand River on the south and Pettis reached to the Osage. The Platte Purchase was not yet made and Clinton extended from Clay to the north line of the State. Chariton also extended from the Missouri River to the northern boundary, and Missouri was bounded by Wisconsin Territory on the north. From Potosi westward to the Gasconade River we find the "Black Hills." The Ozark Mountains extended from northwest Arkansas northeastwardly to central South Missouri.

On Morse's Map of the United States, 1844, the south and west boundary of the United States is: beginning at the south, the Sabine River and west boundary of Louisiana to Red River, thence up Red River to a little west of the twenty second meridian west from Washington, thence north to Arkansas River, thence up said river to the summit of the Rocky Mountains about west longitude 29° from Washington, thence along the crest of said mountains northwestwardly to the parallel of 42°, thence west to the Pacific Ocean. Our north boundary was 49°, as far west as the Rocky Mountains, but west of these we claimed to 54°, 40′. The strip between 49° and 54° 40′ was soon after ceded to Great Britain. Oregon included all of the United States west of the Rocky Mountains, and Indian Territory all west of Arkansas and Missouri, with Missouri Territory lying north, and Iowa extended from Missouri to British America, with Wisconsin on the east and Missouri Territory on the west. Texas was independent and

not yet annexed to the United States. California and New Mexico still belonged to Mexico.

In Maps of Goodrich's history, 1853, Minnesota has a place north of Iowa with Missouri Territory and Indian Territory, as on Morse's Atlas. The north boundary of Oregon was 49°, and Utah included Nevada, and New Mexico included Arizona, and they were portions of the domain of the United States.

On Mitchell's Map, 1864, the United States have their present boundary and all the States their present boundaries, but Idaho comprised all of the present Territory of Montana and part of Wyoming. Wyoming Territory did not as yet occupy a place upon our maps, but it has since been taken off from portions of Dakota, Idaho and Nebraska.

THE MINES OF OLD MEXICO.

Pachuca, Real del Monte, El Chico and Santa Rosa, in the State of Hidalgo, are among the richest mining districts in the Republic of Mexico. Pachuca is the capital of the State, and lies fifty-seven miles north of the City of Mexico. The journey can be easily made by means of the Vera Cruz Railroad, with which Pachuca is connected by a tramway. As the tramway approaches Pachuca the mountains seem to draw near, one of them having on its summit a stone formation which, in the distance bears a striking resemblance to a huge cathedral with domes and towers. It is in the region of this grand cathedral that some of the richest ores are found.

It is obvious the advantage of this region over other districts in Mexico, being thus easily connected with the great capital and having easy access to the coast. That miners have availed themselves of this advantage is shown by the list of mines: Pachuca works 154, Real del Monte 76, El Chico 24, Santa Rosa 13—a total of 267. The powerful "Real de Monte Mining Company" works 77 of these. Real Del Monte lies to the northeast of Pachuca, El Chico to the north, and Santa Rosa to the northwest.

From the time of the conquest up to the present date it is estimated that these four districts have yielded $1,000,000,000 out of $4,000,000,000, the total amount extracted from the mines of Mexico. The Aztecs, before the conquest sought silver in these regions, and after the subjugation innumerable Spanish miners dug holes in the mountains, extracting what ore they could before their works were obstructed by water, when they abandoned them to dig other holes. The silver was obtained by smelting by the early miners, but it was in 1557 a Spaniard named Bartholeme de Medina discovered, in Pachuca, the process of amalgamation with mercury. His discovery is the basis of the "patio" process, which is the system most in use in Mexico, having been found, so far, the cheapest and possibly the best adapted to the country.

The ore when brought from the mine is cracked into small pieces and assorted according to its richness by hands employed for the purpose; it is then

put in sacks and carried by mules to an "hacienda de beneficio." Here it is ground to a fine powder by being crushed between huge revolving stones, turned by horse-power. These grinding stones are called "arrastres." When the ore is sufficiently fine it is mixed with mercury and salt by means of mules tramping through it an average period of ten days. The mass is then washed, the refuse passing off with the water, the amalgam sinking to the bottom. This washing is done in Pachuca by men who steady themselves with ropes hanging from the roof of a shed and walk backwards and forwards in the "torta." As the water is allowed to pass off it runs through a narrow channel, the bottom of which is laid in ridges. In this channel little boys shuffle their feet about, detaining in the ridges any portions of metal that may pass off. The boys earn twenty-five cents a day for this work. For the most part these workers looked chilled and unhealthy, splashing around in the muddy water. In Guanajuato the washing is done by means of hugh stones revolved in the water. When the water passes entirely off from the works the natives often obtain from it large quantities of silver. Many of them are at this work all day in the waste water as it leaves the "beneficio." The process of separating the silver from the mercury is simple and well known. In Pachuca there are seven reduction works, most of them on this system. There is but one "pan" mill so far established. Foreigners are at present trying to introduce improved methods and machinery. This, when accomplished, will be of great service, as ores not yielding more than $30 a ton are not considered worth working by the present process. Great quantities of these depreciated ores lie outside the mines waiting for some less expensive method. Miners not owning their own works can have their metal reduced at the "beneficios" at $20 or $22 a ton, with a charge added for the loss of mercury, which is about ten per cent of the quantity used.

The immense wealth of these regions was proved by one Pedro Jose Bornero de Terreros, a Spaniard, in 1739. He having acquired a fortune in Queretaro, started for his native Spain, but on his way he stopped to look into the mines of this region. He became so much interested that he soon put into them his entire fortune. In this he was assisted by Bustamente, a friend who joined his enterprise. When their capital was exhausted, nothing daunted, Bustamente returned to Queretaro to raise funds and Terreros went for a like purpose to the City of Mexico. Bustamente failed, but Terreros returned to his mines to be reimbursed, when finally he brought out of them $11,000,000 and the title of Conde de Ste. Maria de Regia—Regia being the name of one of his mines.

Santa Gertrudis, one of the mines now in "bonanza," has within the last four years given a gross yield of $4,000,000. It is as yet only worked 160 yards deep. More than $2,000,000 has been paid over to shareholders in dividends or used for improvements in the mine. It has an engine of fifty horse power, for which was paid $75,000. The hoisting apparatus is often moved in these mines by horse power. The machine is called a "malacate." In the region of Santa Gertrudis, San Pedro, Rosaria, Guatomotzin, etc., ores vary from $20 to $300 per ton even running as high as $500. The ores found in the region of Santa

Rosa contain quite a percentage of gold; selected ores have assayed $15.20 gold, $103.50 silver per ton. From Cueva Santa selected ore has assayed up to $350 per ton of silver.

Pachuca has a population of 25,000, which is increasing rapidly by the incoming of miners, drawn thither by mines in bonanza. A considerable part of the population is made up of Cornishmen, who are for the most part the skilled laborers in the mines. They make $3 per head a day, while Mexican skilled labor can only claim $1 a day, and common labor thirty-seven and a half cents. The miner working at $1 a day is entitled to one eighth of the ore he obtains. Owing to this he loses no time, and bends all his energies to make his eighth as large as possible. A man is only employed twenty-four hours a week, in order that all may have a chance at work. This, however, may be the case only in some of the mines. The Real del Monte Mining Company pays as much as $30,000 a week to miners and it is estimated that as much as $75,000 is paid out by the four mining districts together.

Of all objects of interest in Pachuca and its vicinity there is nothing so beautiful as the road from Pachuca to El Chico. A narrow bridle-path runs over the mountains fifteen miles. The mountains themselves from their very height lend a grandeur to the scene. For some distance they are crowned with huge perpendicular rocks, which are called the "Frailes," perhaps because they look so stern and grave. One points a great stone finger up to heaven. At one spot is passed a great rock projecting from the mountain-side under which twenty persons could find a shelter if not made nervous by its curious poise; but this and other great boulders that the stone monks have rolled down from above, seem to have stopped a moment (grown into centuries) in their downward course. Another mountain with a rocky crown has on its summit a huge stone eye to which the heavens give a blue pupil. Still another bears on its crest a solitary tree for which the birds of the air must have sown a seed long years ago. At the most beautiful point in the road two huge moss covered boulders meet in a bend, and above them two others. Over these mossy steps from opposite directions two laughing streams come dancing; they take the fall together, and dash down the ravine, jumping moss-grown trees that fall across the way, and curving great round rocks encased in moss and dotted with anemones. The trees around have a hidden ambition for ship masts, or great beams in the mines, they stand so tall and straight, holding their heads high even on the edge of a ravine, never deigning to stoop forward or bend in their dignity. Here and there a red cross is thrown out against the green, marking the kilometers of the way, and redeeming the pass from a devil's haunt. This region is so high it never knows the drouth and parched aspect of the dusty dry season; it is always an emerald, one of Mexico's jewels without price.

The road from Santa Rosa to El Chico is rugged and picturesque, but lacks the verdant freshness of that of El Chico. It was on this road that we travelers sought shelter in a "palqueria," "El Angel." It was rather surprising to find ourselves sitting on "The Angel's" bar. It is wonderful with what rapidity the

rain creates mountain torrents; an hour will serve to convert a pebbly path over which one has walked, into a hoarse, raging stream, defying a passage. On this ocsion El Chico, as the clouds lifted, was as pretty as a picture. It differs from other Mexican villages in having peaked thatched roofs, and with its pointed caps nestled against the mountain, is unusually attractive to the traveler's eye. In every direction when crossing the mountains can be seen the tall red chimneys of the mines.—*Cor. Globe-Democrat.*

SEWAGE AND SEWERAGE.

The report of Mr. James T. Gardiner to the N. Y. State Board of Health on the methods of sewerage for cities and large villages is a most valuable and interesting document. Mr. Gardiner begins with an unqualified condemnation of the system of privy-vaults and cess-pools; pronounces "dry removal" by means of earth-closets or pails to be much better, but open to serious objections, as requiring constant vigilance and intelligence on the part of householders; declares the ordinary method of combined sewerage, in which both the sewage proper and the much larger body of storm-water are conveyed together in subterranean sewers to be, from the sanitary stand-point, a failure; and finally praises as the best plan yet devised, the separate sewerage, by which *excreta*, slops, and waste-water are removed through mains, while storm water is either provided with separate conduits of large dimensions, or led off on the surface to natural channels of outflow. The most perfect example of this system is found in the sewerage of the city of Memphis, designed by Col. George E. Waring, the eminent sanitary engineer, and operated since 1880 with complete success. Mr. Gardiner quotes at length from a report of Mr. C. H. Latrobe, who examined the Memphis system for the city of Baltimore.

The most striking points of Mr. Gardiner's paper are these:

1. There is probably no such thing as a poisonous "sewer-gas," to which the diseases caused by the admission of sewer air into dwellings may be ascribed. No proof exists that ammonia, sulphureted hydrogen, or any other gaseous products of organic decomposition, do or can cause zymotic diseases. On the contrary there is much evidence going to show that these diseases are produced according to the so-called "germ theory," by *bacteria*, the germs of which are developed in the sewer-air under the favoring conditions of heat, moisture, darkness, and the presence of ammonia, and growing thus on the damp walls of sewers, may float off and be borne like dust on the atmospheric currents.

The reader's first impression may be, that this is a distinction of little practical importance. What difference does it make to the victim of bad plumbing, to be told that he is poisoned, not by the gas from the sewer, but by germs in the gas from the sewer? The practical difference to the moribund victim may indeed be nothing; but it is highly important to prudent people, not yet about to die, and to sanitary engineers. For it follows, first, that the odor of sewer-gas,

though a useful warning of its presence, is not a measure of its poisonous character. A slight odor, given by air from a large and ventilated sewer, may accompany the maximum proportion of *bacteria*. Again, since damp exposed sewer-walls favor the multiplication of these low organisms, it is evident that large brick sewers, which run full in a heavy rain, and half full or nearly empty at other times are the worst that can be used for this purpose, and not the best, as many engineers have supposed, and as indeed would be the case, if the dilution of the sewer-gas with the air were an efficient means of rendering it harmless.

2. The large sewers have been adopted for this reason partly, and partly because they were required to convey sudden accumulations of storm-water, and it was thought a good thing to combine the two things, and secure a periodical natural flushing of the sewers. But it now appears that the best possible conduit for *excreta*, grease, and waste-water would be one exposing a minimum interior surface, and also permitting, by its small size, the use of enamel on that surface. This smooth material is easily kept clean, and the conditions for the growth of *bacteria* along the walls are greatly diminished or destroyed.

3. But such small sewer-mains would be totally inadequate to carry the storm water, which is, during violent rains, nearly fifty times the ordinary sewage. Hence the necessity of a separate disposal of the storm-water. For the great majority of towns, no sewers would be needed for this purpose. The clean storm-water could be left to flow away to natural channels, as it does in the open country. In such cases, the cost of the small sewer-system would be from one-fifth to one-third only of that involved in the combined system. The estimates for the latter type in Memphis, ranged from $800,000 to $2,225,000; the actual cost of the separate system was $137,000. For towns which require short storm-water sewers to lead the rain-fall to natural channels, the expense would still be generally less than that of the extended and comprehensive combined sewerage. Finally, there are, no doubt, a few large cities, where complete underground systems of storm-water drainage are required. In these cases, the expense of a completed double system will be about one quarter greater than that of the combined system; but the sanitary gain will be worth its cost.

This subject is one of great and growing importance to all cities, and particularly to those which are beginning to organize water-supply and drainage. They will find great economy in beginning right; and the light which modern sanitary science has thrown on the subject comes none too early for them.

The articles on the sanitary condition of New York, contributed by Colonel Waring, some months ago, to the *Century Magazine*, should not be overlooked in this connection. Together with Mr. Gardiner's paper, they contain more "solid sense" on the subject of sewerage than many bulky volumes.—*Engineering and Mining Journal.*

EDITORIAL NOTES.

VOLUME VII commences with this issue of the REVIEW, and we send it forth in the hope that it will meet with so favorable a reception that its future career will no longer be questionable. We are satisfied from a comparison with other magazines and from testimonials received from disinterested sources that the REVIEW is worthy of the patronage of all friends of popular education in the west and that more valuable matter is furnished for the price than by any of its contemporaries.

In addition to this, our terms to clubs and offers of discounts on books and magazines are so liberal that those who avail themselves of them obtain the REVIEW literally and absolutely free of cost.

Again, we claim that as a factor in building up the West, by calling attention to its resources and advantages, it has played no insignificant part, and that those of our subscribers who have the REVIEW sent to distant friends benefit themselves directly or indirectly by the results.

If the REVIEW were a source of profit to its publisher, such remarks might be regarded as egotistical, but when everybody knows that it is strictly a public enterprise and that all he asks is reimbursement of his outlay in publishing it, they are certainly allowable.

IN Philadelphia a committee consisting of seven architects, seven plumbers and seven physicians and citizens has been appointed to provide a plan for a systematic management of Sanitary matters and has recommended to the city council an ordinance with rules and regulations for regulating plumbing, house-drainage regulation and licensing of plumbers in that city. These rules and regulations are admirable and something similar should be adopted by municipal governments all over the country. Published by P. Blakiston & Co.; price 10 cents.

IN the Proceedings of the Philadelphia Academy of Sciences Prof. Cope stated that the existence of Man in the Pliocene period would in his opinion soon be demonstrated, and adduced the Calaveras skull, said to have been found in the gold-bearing gravel of California, as a very strong case in point, since it was partially filled with the solid adhesive "cement," characteristic of that ancient formation. At the same meeting Professor H. Carvill Lewis objected to the Calaveras skull as a proof of the antiquity of man, on the ground that the implements found with it were of modern workmanship, and the skull itself resembles that of a modern Indian. Neither is the compact gravel adhering to it and in which it was found shown to have been previously undisturbed.

MESSRS. JOHN WILEY & SONS announce the publication by them of the United States and British Official Metric Conversion Tables, with an introduction by Professor R. H. Thurston. It is an octavo volume of ninety-six pages, and will be sold at $1.00. This book will be found useful to every civil, mining or mechanical engineer as well as to all other persons interested in scientific measurements and rules.

MR. HERBERT B. ADAMS is editing a series of articles upon Historical and Political Subjects entitled "Johns Hopkins University Studies." Those received so far are Number III, Local Government in Illinois, by Albert Shaw, A. B., and On Local Government in Pennsylvania, by E. R. L. Gould, A. B.; No. V, Local Government in Michigan and the Northwest, by Edward W. Benns, A. B., and No. VI, Parish Institutions in Maryland with illustrations from Parish Records, by Edward Ingle, A. B. These papers will be valuable contributions to American literature and history.

GENERAL Passenger Agent W. F. White, of the Atchison, Topeka & Santa Fe R. R., with characteristic liberality gives the Press Association of Kansas an excursion to Chihuahua, Old Mexico, on the 10th inst., which will doubtless prove an extremely gratifying and instructive trip, and one which will result in a more full and complete "writing-up" of that comparatively unknown portion of the continent than it has ever received. Having accepted an invitation to accompany the party we shall pay especial attention to the geological, mineralogical, meteorological and archæological features of the country along the whole line, so as to be able to give the readers of the REVIEW at least a general idea of its most attractive points in the June issue.

Col. A. C. Dawes, the genial General Passenger Agent of the Kansas City, St. Joseph & Council Bluffs R. R., on the same day starts the Missouri Press Association on a delightful excursion trip to St. Paul, Duluth, etc. Being a member of this Association and having heartily enjoyed several editorial jaunts with it, we hesitated which road to take, but finally concluded that we could not forego this rare chance to "revel in the Halls of the Montezumas."

PROFESSOR CHAS. E. MUNROE, of the U. S. Naval Academy, is publishing a series of notes on the Literature of Explosives, and asks authors, publishers and manufacturers to do him the favor of sending him copies of their papers, publications, trade circulars, or expert testimony in infringement cases.

THE tornado season has commenced. For the next two months we are liable to feel their effects at any time. In this connection we call attention to the articles written by Mr. Finley, of the U. S. Signal Service, and published last June and July in the REVIEW. They will be found to cover the whole subject very fully indeed.

WE learn from Mr. J. P. Finley of the U. S. Signal Service, that the unsettled question of the origin of atmospheric electricity is receiving especial attention at present from the Johns Hopkins University and similar institutions in England, France and Germany, the immediate object being to determine definitely the most approved methods of investigation. Delicate and costly experiments are now being made with this end in view.

WE are indebted to Prof. A. V. Leonhard, of St. Louis, for a copy of his paper upon The Occurrence of Millerite in St. Louis, illustrated with four beautiful artotype plates. Millerite is the minerological specialty of St. Louis, not having been found anywhere else in such abundance and so beautifully developed.

THE interesting and thoughtful article upon "The Age of the Missouri River" in this number of the REVIEW was delivered by Judge E. P. West before the Kansas City Institute. It has been published in a neat pamphlet and is to be sold for the benefit of that association at 25c per copy.

ALL subscribers to the REVIEW desiring their copies bound can have it done in half-morocco for one dollar a volume by leaving their back numbers at this office.

MR. E. P. VINING, Freight Traffic Manager of the Union Pacific Railroad, at Omaha, in remitting for the REVIEW, says "I consider the vocabularies of the South American Indian languages, by Dr. Heath, contained in your last issue well worth the cost of a year's subscription."

PROF. JAMES H. CANFIELD, of the State University of Kansas, has commenced the publication of a monthly Index of Periodical Literature, to contain the alphabetical and topical contents of all magazines sent him for the purpose and to be distributed gratuitously among the institutions of learning and libraries throughout the State. He expects to obtain sufficient advertising patronage to pay expenses of publication, and to remunerate himself by the large number of periodicals he will receive.

S. E. CASSINO & CO. announce a new work entitled "Limestones and Marbles—Their History and Uses"; 1 volume, Royal octavo, (handsomely illustrated), pp. 412, $6.00.

WE find in the Quarterly Report of the Kansas State Board of Agriculture, among other valuable papers, one by Prof. F. H. Snow upon "Injurious Insects and How to Destroy Them." It is eminently instructive and practical, as all of his articles are.

PROF. H. E. SADLER, of the Kansas State Normal School, at Emporia, in renewing his subscription, says of the REVIEW, "It seems to me surprisingly well suited to the needs of intelligent people throughout the Missouri Valley, and I omit no opportunity to say a good word it."

BY August 1st it is expected that the ascent to the summit of Pike's Peak can be made upon a tramway instead of by the present laborious and dangerous horseback plan. The tramway will be in three sections, two of which, the upper and lower, will be operated by steam engines, and the other by water-power. The time consumed in the round trip will be about three hours.

DR. EDWIN R HEATH'S account of his explorations in Bolivia was sent to the Royal Geographical Society, of London, where it was enthusiastically received. Mr. Clements R. Markham, late President of the Society, read a paper before it on April 19th in which he dilated largely upon Dr. Heath's report and gave him the highest credit for intrepidity, perseverance and the achievement of most important results.

TEXAS may be called the land of cactus. One species recently sent by Prof. J. D. Parker from Fort McKavett to Washington, was not contained in the Botanical Gardens there. One species of cactus in Texas bears fine berries which look and taste like strawberries. They sell for twelve cents a quart, and are a great favorite for dessert. One mammoth cactus several feet in diameter is covered over with fiery-red blossoms and looks on the prairie like a little hay-stack on fire.

ITEMS FROM PERIODICALS.

Subscribers to the REVIEW *can be furnished through this office with all the best magazines of the Country and Europe, at a discount of from 15 to 20 per cent off the retail price.*

THE *North American Review* for May contains nine articles, nearly every one of which discusses some topic or problem at the present moment prominent to the public mind. Senator John T. Morgan writes of "Mexico," and sets forth the considerations of commercial advantage and international comity which are rapidly bringing about a more cordial understanding between that country and the United States. The Rev. William Kirkus, taking occasion from Bishop McQuaid's recent vaticinations regarding the decay of Protestantism, makes a vigorous counter charge upon the papal system in an article entitled "The Disintegration of Romanism." In "Emerson and Carlyle," Edwin P. Whipple discourses with all his old-time keenness of psychological insight and perfection of literary form upon the strangely diverse mental and moral characteristics of those two great thinkers. Prof. Felix Adler offers "A Secular View of Moral Training," arguing that the current skeptical habit of thought demands an independent system of practical ethics, based primarily on observation rather than on revelation. "Communism in America," by Prof. Alexander Winchell, gives very forcible expression to the apprehension of those pessimistic observers of the trend of events in this country who think that they see in our political and social development all the signs of impending national decay. The other articles are "Affinities of Buddhism and Christianity," by the Rev. Dr. James Freeman Clarke; "Woman as an Inventor," by Matilda Joslyn Gage; "College Endowments," by Rossiter Johnson; and "Extradition," by A. G. Sedgwick.

THE *Tennessee Journal of Education* makes its first appearance with the March number. It is a large folio of twenty-four pages edited by Colonel Leon Trousdale and published by Wheeler & Osborn, Nashville, Tenn. It presents a fine appearance and being one of the very few educational magazines of the South, should be well supported. $1.00 per annum.

BULLETIN No. III of the American Geographical Society contains a very valuable article upon the exploration of the River Beni in Bolivia, by Dr. E. R. Heath, of Wyandotte Kansas, with a map of the region. The principal points in this article were first published in the REVIEW for September, 1881, and widely copied. The Bulletin also contains an article by General Egbert L. Viele on the Frontiers of the United States, with map.

Harper's Magazine for May is on hand more promptly than usual and presents the following bill of fare: "The Sisters," (frontispiece), engraved from a Picture by E. A. Abbey. San Francisco—William Henry Bishop, with eleven illustrations. The Treaty of Peace and Independence, II.—George Ticknor Curtis, with seven portraits. The Singer; A Poem.—Herbert E. Clarke. Nehemiah's Plan; A Story.—Kate W. Hamilton. The National Academy of the Arts of Design, and its Surviving Founders.—Benson J. Lossing, with three portraits. A Castle in Spain; A Novel, Part I, with six illustrations by Abbey. Galatea; A Poem.—Elizabeth Stuart Phelps. Roman Carnival Sketches.—Anna Bowman Blake, with nine illustrations by Reinhart. Anthony Trollope.—Walter Herries Pollock, with portrait. The Middle Colonies before the Revolution.—John Fiske. Fresh Air in Summer.—Titus Munson Coan. The Brooklyn Bridge.—William C Conant, with twenty-one illustrations. Art Study at Home and Abroad.—John F. Weir. The Oldest Friend; A Poem.—Louise Chandler Moulton. Editor's Easy Chair. Editor's Literary Record. Editor's Historical Record. Editor's Drawer.

Science for April 6th contains a sensible editorial upon the present ill regulated distribution of public documents, and advocates a single agency for all such distributions, giving public libraries the first care and supplying individuals afterward. As we understand it, under this plan all applications to Congressmen and the different departments and bureaus will be referred to this distributing agency with proper recommendations, which prevent duplication and insure appropriate selections, both of which are exceedingly desirable.

THE *Humboldt Library*, No. 43, furnishes its readers with the Lives and Work of Darwin and Humboldt, the first by Prof. Huxley and others, and the second by Prof. Louis Agassiz, forty six pages, octavo; price 15c.

THE contents of the *Popular Science Monthly* for May are as follows: The Remedies of Nature—Comsumption, by Felix L. Oswald, M. D. Science and Conscience, by Professor Thomas Sergeant Perry. Physics in General Education, by Professor T. C. Mendenhall. Microscopic Life in the Air, by Louis Olivier, (Illustrated). How Much Animals Know. By F. A. Fernald. Chemistry and Pharmacy, by Professor Ira Remsen. Position and Stroke in Swimming, by R. Lamb, C. E., (Illustrated). How the Ancient Forests Become Coal, by M. G. De Saporta. A Superstitious Dog, by Eugene N. S. Ringueberg. From Buttercup to Monk's-Hood, by Professor Grant Allen. On the Colors of Water, by M. W. Spring. A Wonder from the Deep Sea, by M. L. Vaillant, (Illustrated). Gymnastics, by Alfred Worcester, A. M. Why are We Right-Handed? by W. C. Cahall, M. D. Lengthening the Visible Spectrum, by Johannes Götz, (Illustrated). The Boundaries of Astronomy, I,—Is Gravitation Universal? by Robert S. Ball, F. R. S. On Brain-Work and Hand-Work, by R. M. N. Sketch of Professor Richard Owen, F. R. S., (with Portrait). Correspondence. Editor's Table. Literary Table. Popular Miscellany. Notes.

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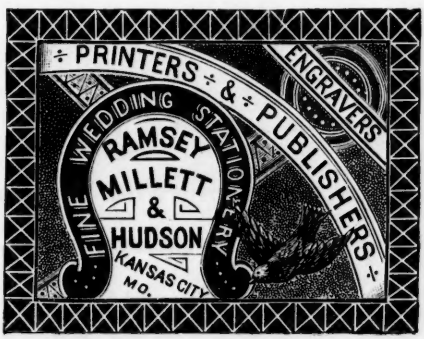

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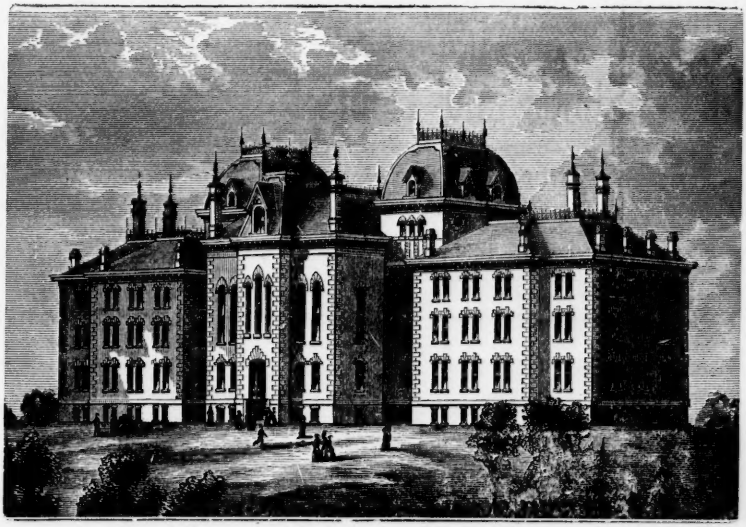

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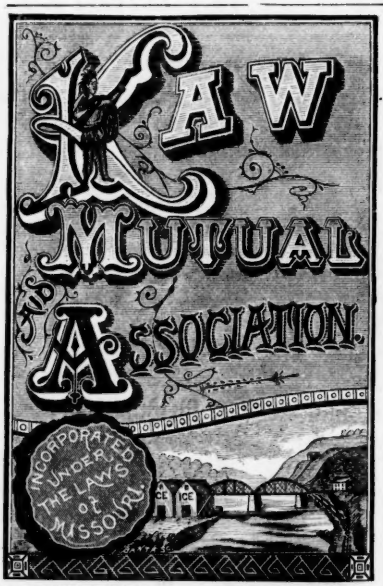

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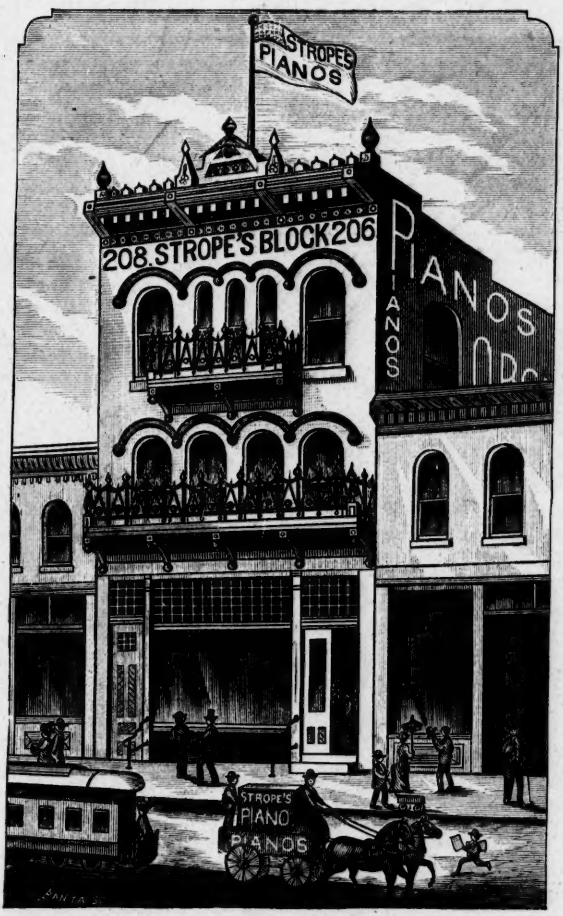

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